

Source Water Protection

A Guidebook for Local Governments



Conference of Southern County Associations
National Association of Counties
Georgia Water Management Campaign

in cooperation with



Carl Vinson Institute of Government
The University of Georgia

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CONFERENCE OF SOUTHERN COUNTY ASSOCIATIONS

The Conference of Southern County Associations (CSCA) is a nonprofit organization representing 14 states, over 1,400 counties, and thousands of local government officials throughout the southeastern United States. The mission of CSCA is to coordinate and to provide an opportunity for the officers, directors, and staffs of southern county associations to share mutual political and policy concerns with their counterparts throughout the southern region. CSCA serves as an organization and network to assist its members in sharing environmental information, technical support, and educational opportunities. CSCA is supported by an Intergovernmental Personnel Assignment (IPA) from the U.S. Environmental Protection Agency, Region 4.

Participating state associations in CSCA include: Alabama, Arkansas, Florida, Georgia, Kentucky, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.



NATIONAL ASSOCIATION OF COUNTIES

Founded in 1935, the National Association of Counties (NACo) is the only national organization in the country that represents county governments. With headquarters on Capitol Hill in Washington, D.C., NACo's primary mission is to ensure that the county government message is heard and understood in the White House and in the halls of Congress.

NACo's purpose and objectives are to—

- serve as a liaison with other levels of government;
- improve public understanding of counties;
- act as a national advocate for counties; and
- help counties find innovative methods for meeting the challenges they face.

NACo's Source Water Protection Project

NACo's Source Water Protection Project provides information on technical assistance including tools, techniques, and resources available to local governments to protect drinking water. NACo's Source Water Protection Project is funded by a Cooperative Agreement with the U.S. Environmental Protection Agency (EPA Grant # CX 824412-01-6).

GEORGIA WATER MANAGEMENT CAMPAIGN

The Georgia Water Management Campaign is a cooperative effort among the Georgia Environmental Protection Division, Georgia Environmental Facilities Authority, Association County Commissioners of Georgia, and the Georgia Municipal Association. The campaign was established to enhance local governments' ability to manage and protect water resources by translating water management policies into local government decision-making capabilities, guidance, and technical assistance. The focus of the campaign is to—

- increase communication among local, state, and federal governments, industry leaders, environmental organizations, academia, and professional water associations;
- increase local governments' commitment to the protection and management of water resources; and
- provide coordinated delivery of water management technical assistance to local governments throughout Georgia.

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The Carl Vinson Institute of Government has served as an integral part of the University of Georgia for more than 50 years. Its chief objective has been to assist public officials to achieve better government, particularly in Georgia. To this end, it draws upon the resources and expertise of the university to offer an extensive program of governmental instruction, research and policy analysis, technical assistance, and publications.

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The State Associations participating in CSCA include: Alabama, Arkansas, Florida, Georgia, Kentucky, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

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Executive Summary

Public Water Suppliers will greatly benefit from this effort in protecting public health and ensuring that source waters are not susceptible to contamination.

David Mitchell, Director
Mississippi State Department of Health
Division of Water Supply

A reliable supply of safe drinking water is essential for communities to survive and prosper. In fact, from a public health, environmental quality, economic development, public finance, and quality of life perspective, there are few things more important for local government officials to ensure for their residents. While we in the United States enjoy one of the best supplies of drinking water in the world, threats to our drinking water are increasing from both point and nonpoint sources of pollution. In addition, it is increasingly difficult to find new sources to meet growing demands. Technology alone cannot ensure that our water supplies will meet our needs for good quality water; greater emphasis on protecting water sources is necessary.

Historically, local governments have carried out provision of public water supplies. Securing, treating, and distributing water have been local responsibilities, if the local government chose to undertake them. Financing these services was also left to the local government. This is still true today, but there is greater federal and state involvement in the drinking water arena. Since the passage of the Safe Drinking Water Act in 1974, the focus of federal and state efforts has been primarily on requiring that drinking water be treated to meet certain standards. With enactment of the 1996 amendments to the Act, greater emphasis was placed on protecting the sources of drinking water from contamination. The thrust of the amendments is to require source water assessments to be conducted with the intent that, once the assessments are completed, source water protection measures will be instituted. The United States Environmental Protection Agency (USEPA) has established a national goal that by the year 2005, 50 percent of the population that is served by community water systems will receive drinking water from systems with established source water protection programs.

The first step in protecting water sources is for source water assessments to be conducted. The 1996 amendments to the Safe Drinking Water Act require states that have primary enforcement responsibility (primacy) for the Safe Drinking Water Act to develop and submit a source water assessment plan for approval by the USEPA. Within two years of plan approval (with a possible 18-month extension), states are required to have completed assessments of all public water systems that include:

- delineation of the source water protection area;
- inventories of potential contamination sources; and
- determinations of susceptibility of the drinking water supply to contamination.

The source water assessments will provide specific information on threats to local water supplies and the likelihood of the water supplies becoming contaminated. Consequently, source water protection programs can target actions to those threats that pose the greatest risk to the water system. Responsibility for conducting the source water assessments will vary by state. No matter how the assessments are done, however, local governments should be involved in the process since the assessments will be used as the basis for instituting source water protection measures.

The purpose of this guidebook is to help local governments ascertain how to protect surface and ground water sources for drinking water supplies. It is designed to help local officials:

- identify why source water protection is important to their community;
- understand the source water assessment requirements and source water protection expectations under the Safe Drinking Water Act;
- recognize the activities and facilities that might threaten drinking water sources; and
- develop actions to prevent or minimize threats to water supplies.

There are no new requirements under the Safe Drinking Water Act directing drinking water providers or local governments to protect their water sources. Yet it is critical for local officials to take such actions in order to safeguard public health, the quality of the environment, public finances, economic vitality, and the quality of life in their jurisdictions. Options available to local officials to protect water sources include:

- land use tools (i.e., zoning, alternative zoning tools, subdivision requirements, building codes);
- wet weather runoff tools (i.e., storm water management, erosion and sedimentation ordinances, intergovernmental coordination and agreements);
- public health tools (i.e., contaminant-specific and source-specific health measures); and
- nonregulatory tools (i.e., pollution prevention, restoring contaminated sites, land acquisition, water conservation and reuse, public education and awareness, emergency response planning).

Each local source water protection program will be unique due to variation in the hydrogeologic characteristics of the drinking water source, the presence and type of threats in the vicinity of the water supply, and the measures adopted by the local government to address those threats. To ensure that the community water supply remains safe, it is likely that the source water protection program will include both corrective and preventive water protection measures.

Clean, safe drinking water sources are essential for community wellbeing. Consequently, it is important that local government officials be involved in the source water assessment process and move aggressively toward protecting water supplies once the assessments are completed. Source water protection programs should involve a partnership of federal, state, and local governments, stakeholders, and the general public. An open, cooperative effort can identify and minimize threats to drinking water quality, safeguard current and future citizens from water-borne maladies, protect environmental quality, and support the economic viability of the community.

The following Local Government Checklist for Source Water Protection may help determine what your community has accomplished to date relating to source water assessment and protection. It can also guide in the development of a source water protection program, identifying those actions that remain to be addressed. In addition, the checklist may be used as a tracking system to determine progress toward fulfilling source water assessment and protection responsibilities.

Local Government Checklist for Source Water Protection

- ✓ ☐ Do you know why source water protection is important to your community?
- ✓ ☐ Have you contacted the state agency responsible for safe drinking water?
 - ☐ What approach has the state selected to complete source water assessments?
 - ☐ What is expected of the drinking water permit holder in the assessment process?
 - ☐ What is expected of local governments in the assessment and protection process?
- ✓ ☐ What is happening in your water supply watershed or ground water recharge area?
 - ☐ Have the water supply assessment and protection area(s) been delineated?
 - ☐ What activities and facilities are in the delineated area that might contaminate drinking water sources?
 - ☐ Has a determination been made of the susceptibility of the drinking water source to the identified potential threats?
- ✓ ☐ What is the toolbox of potential protection activities?
 - ☐ Do you have the authority to implement local regulatory tools?
 - ☐ Are the appropriate ordinances in place?
 - ☐ Have you identified possible nonregulatory protection tools?
- ✓ ☐ Has the community identified protection concerns, goals, and priorities?
 - ☐ Has a stakeholder involvement process been established?
 - ☐ Have you identified who is best able to implement protection actions?
 - ☐ Have you obtained commitments to implementation?
- ✓ ☐ Have you developed intergovernmental coordination agreements necessary to protect the source water protection area?
 - ☐ Are ordinances compatible from one local government to another?
 - ☐ Are enforcement efforts and other protection tools consistent?
- ✓ ☐ Have you developed an emergency response plan?
 - ☐ Has an emergency water source been identified?
 - ☐ Are emergency water supply agreements in place with neighboring communities?
- ✓ ☐ Have you identified federal, state and local funding options?
 - ☐ Are funding opportunities available for multi-jurisdictional projects?
- ✓ ☐ Have you addressed implementation considerations?
 - ☐ What are the source water protection action priorities?
 - ☐ What tools best match protecting drinking water supplies with specific threats?
 - ☐ How will progress toward source water protection be measured?
 - ☐ Have you considered issues of equity – who pays and who benefits?

Introduction

*There shall be no man or woman dare to wash any unclean linen, wash clothes, ...nor rinse or make clean any kettle, pot or pan, or any suchlike vessel within twenty feet of the old well or new pump. Nor shall anyone aforesaid within less than a quarter mile of the fort, dare to do the necessities of nature, since by these unmanly, slothful, and loathsome immodesties, the whole fort may be choked and poisoned.*¹

Lord Delaware
1610

Historical Perspective

As Lord Delaware's directive shows, recognition of the need for a clean supply of drinking water is not new. In fact, this understanding played an important role in the development of the United States, as well as the rest of the world. Early settlements were established near a reliable source of clean water. As our population expanded, the need for a reliable source of safe drinking water continued to determine the location of population centers across the country.

In this age of technology, however, we have moved away from protecting our water sources, relying instead on treatment to clean water before we use it. Nationwide, owners and operators of drinking water systems have spent hundreds of billions of dollars to build treatment and distribution systems, and they spend an additional \$22 billion per year to operate and maintain them.² These efforts have paid off in generally clean, safe water. Of the more than 55,000 community water systems* in the United States, only 4,769 or 8.7 percent reported a violation of one or more drinking water health standards in 1996.³

While we in the United States enjoy one of the best supplies of drinking water in the world, threats to the quality and quantity of our drinking water sources are increasing. From short-term disease outbreaks linked to contaminated drinking water to restrictions on water use during drought periods, we can no longer take our drinking water for granted.⁴ Technology alone cannot ensure that our water supplies will meet our need for clean drinking water. As a result, our efforts must focus more on protecting our water sources at the local level where local buy-in and initiative have proven to be the most successful at protecting drinking water sources.

* **Community water systems** are public water systems that serve people year-round in their homes. **Public water systems** serve treated or finished water to at least 15 service connections or an average of 25 persons for at least 60 days per year. Such systems may be owned by homeowner associations, investor-owned water companies, local governments, and others. Water that does not come from a public water supply, and which serves one or only a few homes, is called a **private water supply**. (United States Environmental Protection Agency. *A Consumer's Guide to the Nation's Drinking Water*, (USEPA 815-K-97-002), Office of Water, July 1997, pg 5).

Safe Drinking Water Act

Federal laws provide the legal basis on which national, state, and local programs are developed to protect water quality. The federal law most directly designed to protect both surface water[†] and ground water[‡] used for drinking water purposes is the **Safe Drinking Water Act**. It was enacted on December 16, 1974, to protect public drinking water systems in the United States from harmful contaminants. The Act directed the USEPA to develop:

- national primary drinking water regulations;
- underground injection control regulations to protect ground water drinking sources; and
- protection programs for sole-source aquifers.[§]

Implementation of the Act was slow and, as a result, in 1986 Congress amended it to speed up the USEPA's adoption of standards and implementation of protection programs. Notably, the 1986 amendments include provisions requiring the USEPA to:

- set drinking water regulations for 83 specified contaminants by 1989;
- establish requirements for disinfection and filtration of public water supplies and provide related technical assistance to small communities;
- ban the use of lead pipes and lead solder in new drinking water distribution systems;
- establish mandatory state wellhead protection programs for public water supply wells (states may then develop a voluntary local wellhead protection program);

[†] Surface water is the water that runs over the surface of the earth and forms streams, rivers, and lakes.

[‡] Ground water is the water that percolates down through the soil to fill porous spaces in the soil and cracks, fissures, and solution channels in the bedrock. The upper level of the ground water is known as the water table.

[§] Sole-source aquifers are the principal source (50 percent or more) of the community's drinking water supply. Aquifers are geologic formations that contain water. The water may fill pore spaces between soil particles or in porous rock or it may fill cracks, fissures, or solution channels in rock formations. The quantity of water in an aquifer and the water produced by a well depend on the nature of the rock or soil in the aquifer where the well withdraws water. Drinking water wells may be shallow (50 feet or less) or deep (more than 1,000 feet).

Ground water comprises more than 97 percent of available fresh water supplies (Paul Jehn. *The Ground/Surface Water Connection: Drinking Water Source Protection Involves Both!* *River Voices*, Fall 1996.) In the U.S., it is the predominant source of supply for community water systems. Close to 89 percent of the community water systems rely on ground water as their primary source, and most of these systems (85 percent) are small, serving fewer than 3,300 persons each (American Water Works Association. *Source Water Protection: Effective Tools and Techniques You Can Use: 1999 Participant Manual*, Denver, Colorado, 1999). Fifty-three percent of the U.S. population obtains its drinking water from ground water sources (United States Environmental Protection Agency. *Water on Tap: A Consumer's Guide to the Nation's Drinking Water*, (USEPA 815-K-97-002), Office of Water, July 1997). Although only about 10 percent of the community systems depend on surface water sources, these surface water systems tend to be the larger ones that provide water to nearly half the people in this country.

- establish a demonstration grant program for states and local authorities having designated sole-source aquifers to develop ground water protection programs; and
- issue rules for monitoring wells that inject wastes below a drinking water source.

To date, the USEPA has established close to 80 National Primary Drinking Water Standards for specified contaminants (see Appendix A). The agency has also issued secondary drinking water regulations that protect the public from drinking water with an unpleasant odor or appearance. These secondary standards are merely guidelines for public water utilities to follow; they are not enforceable.

In 1996, Congress amended the Safe Drinking Water Act again. The 1996 amendments place greater emphasis on protecting surface and ground water sources used for public drinking water supply. This emphasis was reflected in new statutory requirements for states and for water supply permit holders (i.e., local governments, nonprofit utilities, authorities, and private concerns).

One such requirement is the development of **source water assessments** for surface and ground water public drinking water supplies. The assessments are a three-part effort:

1. a delineation of the source water assessment and protection area;^{**}
2. an inventory of potential contaminant sources; and
3. an analysis of the susceptibility of the public water supply to those identified potential contaminant sources.

The purpose of the source water assessments is to help those who provide drinking water to identify potential threats to their source(s) of water so protective measures can be taken. The 1996 amendments only require assessments; yet the intent is that actions will be taken by the states and water providers to protect water sources. Consequently, the comprehensive evaluation of the susceptibility of water supplies to contamination and the detailed evaluation of a broad range of contaminants in use in the vicinity of the water source are intended, not as isolated activities, but to support the development of local **source water protection programs**.

^{**} A source water assessment and protection area defines the drainage area over which or through which water flows to a public water system's surface water intake, ground water well, or spring.

For surface waters, the source water assessment and protection area is defined as the watershed surrounding the stream or lake that serves as the source for raw drinking water. It should include the entire watershed up to the state's borders but will likely focus on the portion of the watershed directly upstream and uphill from the surface water intake.

For ground water sources, the wellhead assessment and protection area is defined by the subsurface water body or aquifer tapped by the drinking water well (American Water Works Association. *Source Water Protection: Effective Tools and Techniques You Can Use: 1999 Participant Manual*, Denver, Colorado, 1999). The protection area may not include the entire aquifer but rather the portion of the aquifer that is in close proximity to the well.

Important Messages

Conducting source water assessments is a new approach for many areas nationwide. Federal and state agencies are engaged in fulfilling their responsibilities relative to completing these assessments. Actual source water protection, however, involves controlling what happens on the land and, in almost all areas of the country, land use control authority typically rests with local governments. Assistance will be available from federal and state agencies, but ultimately the responsibility rests with local government, even if it is not the drinking water permit holder. Therefore, the following are four important messages for local government officials.

1. Federal law requires that state and/or local governments do source water assessments.
2. The threats to your water supply identified by the assessments will be available to the USEPA, to your state, to your local government, and to the residents of your jurisdiction.
3. There is an expectation that state and local governments will use the source water assessments to institute source water protection programs.
4. From a public finance, economic development, environmental quality, public health, and quality of life perspective, it is in the long-term best interest of local governments to participate in developing and/or reviewing the source water assessments and in instituting source water protection programs.

Whether the state or local governments conduct the assessments and regardless of who owns and operates the public water supply(s), undertaking specific actions to correct existing threats or to prevent future threats to community water supplies will, to a large extent, be driven by local government leadership and initiatives. Protecting ground and surface water sources may require a mix of regulatory and nonregulatory strategies. Regulatory strategies include government actions relating to land use control and health regulations, while nonregulatory strategies involve actions such as pollution prevention, education, and land acquisition. In addition, protecting water supplies will require a concerted intergovernmental effort in which communication and the participation of stakeholders will be key.

Purpose

The purpose of this guidebook is to help local governments ascertain how to protect surface and ground water sources for drinking water supplies. It has been produced to clarify the role of local government in the source water assessment process and to encourage local government involvement in that process. Part I sets the stage for source water protection by providing an overview of the federal, state, and local roles and suggests steps in planning a source water protection program. Part II of this guidance offers a toolbox of protection measures from which local governments can pick and choose those that will work best in their community and political situation. Part III describes considerations, such as prioritizing actions, matching tools to threats,

the role of water monitoring, and equity, that are important for implementation of source water protection programs. This document is designed to help local officials:

- identify why source water protection is important to their community;
- understand the source water assessment requirements and source water protection expectations under the Safe Drinking Water Act;
- recognize the activities and facilities that might threaten drinking water sources; and
- develop actions to prevent or minimize threats to water supplies.

There are no new requirements under the Safe Drinking Water Act directing drinking water providers or local governments to protect their water sources. Yet it is critical for local officials to take such actions in order to safeguard public health, the quality of the environment, public finances, economic vitality, and the quality of life in their jurisdictions.

Why Source Water Protection

There are a number of reasons why local governments should place greater emphasis on protecting their drinking water sources. Certainly, the most important is the protection of public health, safety, and welfare, although environmental quality, public finance, citizen awareness and expectations, and legal responsibility and authority are critical reasons also.

Public Health

- **Contaminated Water Supplies.** Because water is the “universal solvent,” many materials are easily dissolved upon contact. At low levels, these contaminants generally are not harmful in drinking water. Removing all contaminants would be extremely expensive and in nearly all cases would not provide greater protection of health. A few of the naturally occurring substances may actually improve the taste of drinking water and may have nutritional values at low levels.⁵

The most important reason local governments should protect their drinking water sources is the protection of public health, safety, and welfare.

Microbiological and chemical contaminants can pollute water supplies. These materials may occur naturally or result from human activity. For instance, chemicals can migrate from disposal sites to contaminate sources of drinking water. Animal wastes and pesticides may be carried to lakes and streams by rainfall runoff or snow melt. Human wastes may be discharged to receiving waters that ultimately flow to water bodies used for drinking water.

The potential for health problems from drinking water is illustrated by afflictions to vulnerable populations and localized outbreaks of water-borne disease. For instance, nitrate, a chemical

contaminant in drinking water, poses a health threat to young children when at levels above the national standard of 10 parts per million. Excessive levels can result in a condition known as "blue baby syndrome" that can be fatal if untreated.⁶ In addition, many local disease outbreaks have been linked to contamination by bacteria or viruses, probably from human or animal waste. In 1993 and 1994, for example, there were 30 reported disease outbreaks associated with drinking water, 23 associated with public drinking water supplies, and seven with private wells.⁷

Certain pathogens, such as *Cryptosporidium*, may pass through water treatment filtration and disinfection processes in sufficient numbers to cause health problems. *Cryptosporidium* is a protozoa that causes the gastrointestinal disease Cryptosporidiosis, which can have serious, and sometimes deadly, consequences, particularly on sensitive populations, such as children, the elderly, and individuals with immune system deficiencies.⁸

A 1993 outbreak of Cryptosporidiosis in Milwaukee, Wisconsin, is the largest outbreak of water-borne disease in the United States to date. Lake Michigan is the source of Milwaukee's water, which is treated by filtration and disinfection. Due to an unusual combination of circumstances during a period of heavy rainfall and runoff, the treatment plant was ineffective, resulting in an increase in the turbidity of the treated water. Increased turbidity can be, and was in this case, an indicator of higher levels of *Cryptosporidium*. Over 400,000 persons were affected by the disease, more than 4,000 were hospitalized, and over 50 deaths (some counts are as high as 100) have been attributed to the disease. The original source of contamination is uncertain.⁹

Environmental Quality

- **Increased risk of contamination.** As development in our modern society increases, there are growing numbers of threats that could contaminate drinking water. Suburban sprawl has encroached upon once-pristine watersheds^{††} and ground water recharge areas, bringing with it all of the by-products of our modern life style.¹⁰ Increases in the number of hogs, cattle, and chickens concentrated in animal feeding operations to feed the growing human population can result in excessive nutrient loading to streams and lakes and contaminate ground water.
- **Local expertise.** Local governments and community residents normally have specific knowledge of their water supply and threats to it. A better assessment can be developed if this vital information is included in the source water assessment process. Further, the most effective protection program will be built on accurate and representative assessments of threats to the water source.

^{††} A watershed is a topographic area within which surface water runoff drains to a specific point on a stream or to a water body, such as a lake. Although any number of points could be picked to identify a watershed, normally a water body or the confluence of streams is used for this purpose. The line connecting all the high points that divide the flow of water between the identified watershed and other watersheds defines the boundary of the watershed. Large watersheds are commonly referred to as river basins (e.g., Colorado River Basin, Delaware River Basin, Chattahoochee River Basin) (James M. Omernik and Robert G. Bailey. Distinguishing Between Watersheds and Ecoregions,® *Journal of the American Water Resources Association*, Vol. 33, No. 5, October 1997, pg 935-949.)

- **Pollution Prevention.** Source water assessments should give local governments and community water suppliers the information needed to target and initiate pollution prevention efforts. The state's source water protection efforts could involve a variety of tools to protect sources of drinking water that involve local implementation, including wellhead protection, watershed protection, and reservoir management.

Public Finance

- **Difficulty securing and developing new water supply sources.** Once a water supply source is contaminated, it may be very difficult and expensive to replace or reclaim it. Some ground water contamination is beyond the capabilities of current remediation technology. Local governments may have to look for new water sources, which are increasingly scarce and, if a new source is secured, tying it into the existing system could be very expensive.
- Once a water supply source is contaminated, it may be difficult and expensive to replace or reclaim it.**
- **Reduction in monitoring and other regulatory requirements.** Source water assessments can establish a scientific basis to support local government eligibility for future grants and loans and to provide greater regulatory flexibility that can reduce operational costs yet maintain the delivery of safe water to the public. According to the USEPA, public water systems that have adequate and updated assessments could receive relief from some monitoring and other regulatory requirements under existing as well as future rules.
 - **Low interest loans and training opportunities.** The 1996 amendments to the Safe Drinking Water Act bolster the ability of communities to upgrade antiquated drinking water filtration and purification systems. The amendments also expand programs to train and certify water treatment plant operators. Local governments can now apply for state-administered loans to construct new water treatment facilities or upgrade old ones. Although a federal revolving loan fund for wastewater facilities has been in existence for some time, this is the first time that a federally financed Drinking Water State Revolving Fund (DWSRF) for water systems has been created.
 - **Funds available to the states.** The 1996 Safe Drinking Water Act amendments make available funds to conduct source water assessment and protection activities. The state agency responsible for drinking water regulation has the authority to set funding priorities and to allocate the funds with guidance from stakeholders. Local government can help shape the state's funding priorities to target assessment and protection activities toward the most critical areas.

Citizen Awareness and Expectations

- **New public notification requirements.** The 1996 Safe Drinking Water Act amendments provide the USEPA with the authority to require notification of customers about the sources of contaminants in tap water. Annual Consumer Confidence Reports (beginning October 1999) must provide information on the levels of federally regulated contaminants and on the presence

of suspicious but still unregulated substances in drinking water. If there is a violation, the reports must also contain information about the health effects of the contaminants in question.

- **Increased customer awareness and concern.** Increased publicity of outbreaks of water supply problems and increased public understanding of environmental matters have resulted in heightened awareness and concern by customers as to problems that might occur with their water supply. Citizens will generally look first to their local government for water quality protection and assurances. Therefore, it is in the local government's best interest to be actively involved in the source water assessment and protection process.

Citizens will generally look first to their local government for water quality protection and assurances.

Legal Responsibility and Authority

- **Pending promulgation of new drinking water standards.** The 1996 Safe Drinking Water Act amendments require the USEPA to adopt new drinking water standards for *Cryptosporidium*, certain carcinogens, and other contaminants that threaten drinking water. These standards will require additional protection efforts by those providing water supply services.
- **Liability.** Federal and state drinking water regulations are in full force and effect in all 50 states. Nevertheless, a water supplier serving contaminated drinking water may be liable under negligence, breach of warranty, and perhaps strict liability theory.¹¹ Water suppliers are legally vulnerable for allowing drinking water to become contaminated. It clearly is both cost-effective and good business to protect water supplies from contamination today rather than risk a future product liability action.
- **Land use control authority supporting source water protection.** The government's role in controlling how land is used is based on the police powers or the power of government to act to protect public health, safety and welfare. Certainly, protecting water supplies is a valid use of land use control authority; however, using it for this purpose has historically varied across the country. In most cases, local governments are authorized to conduct land use and/or comprehensive planning and to influence how land is used based on constitutional and statutory requirements prescribed by the federal and state governments and ordinances adopted by the local governing body.

A water supplier serving contaminated drinking water may be liable under negligence, breach of warranty, and perhaps strict liability theory.

Based on these public health, environmental quality, public finance, citizen awareness, and legal responsibility considerations, it is essential for local governments to protect their drinking water sources. Open communication among local governments, between local governments and their state agency with Safe Drinking Water Act responsibilities, and intergovernmental cooperation remain critical factors in the assessment and protection of drinking water sources.

PART I

Setting the Stage for Source Water Protection

Source Water Protection Under the Safe Drinking Water Act

Protection of drinking water sources is ultimately a direct responsibility of local governments and elected officials entrusted with the wellbeing of the public requiring a collective effort on behalf of all local, state and federal agencies.

Clarence Brown, Sole Commissioner
Bartow County, Georgia

As with most environmental laws, the Safe Drinking Water Act amendments of 1996 identify roles for federal, state, and local governments within a flexible framework.

Federal Role

Federal Safe Drinking Water Act implementation responsibilities are assigned to the USEPA, which establishes standards, program criteria, and funding eligibility. To meet the intent of the law, the USEPA sets national health-based drinking water quality standards and secondary standards, which are advisory, for odors and color. It develops criteria to be met by state source water assessment plans and is responsible for reviewing those plans. The USEPA also provides funding to states to carry out their source water assessment plans and provides funding for the revolving loan funds to be administered by the states.

In addition, the USEPA provides oversight to see that federal requirements are met but generally delegates program implementation responsibility to states. State environmental or health agencies frequently serve as extensions of the USEPA by administering federal programs. All states except Wyoming and the District of Columbia have legal authority (primacy) for supervision of public water systems.¹² Delegation of responsibility to the states allows regional differences to be addressed by authorizing states to design programs in a manner that will work within their jurisdictions. Therefore, states are critical players in determining how the programs will be handled within their jurisdictions, both for conducting the source water assessments and for protecting water supplies. If local government officials have questions about the federal role in source water assessment and protection, Appendix B provides contact information for the USEPA's Regional Offices.

State Role

The regulatory flexibility to shape source water assessment and protection programs means that each state program will be unique. This flexibility is offered because it may not be possible or appropriate to achieve the same level of assessment for all public water systems. Within this flexibility, however, the 1996 amendments require that states:

- develop a source water assessment plan (SWAP);
- develop a strategy for assessment of public drinking water sources; and
- make the assessments available to the public.

The first requirement for the states is to develop **source water assessment plans** (as of February 2000, most states have submitted and received USEPA approval of their plans). The plans specify how each state intends to meet the source water assessment requirements and must include descriptions of:

- the public participation process the state used to develop its plan;
- the approach the state will take to implement its plan and what the state will require in its source water assessments;
- how the state will make the results of the assessments available to the public; and
- how the state expects to implement its SWAP approach.

Once the USEPA notifies a state that its SWAP has been approved, the state will move to implement its plan. The first step will be to conduct source water assessments for all public ground and surface water supplies that lie solely within the state and for supplies that cross the state's boundaries. These assessments must be completed within two years of an approved SWAP (the state may request an extension up to an additional 18 months).

Source water assessments must **delineate the boundaries** of the area that contributes ground water and/or surface water and potential contaminants to the community water systems. The delineation can be based on available hydrogeologic information such as water flow, recharge, and discharge. For ground water systems, the delineation must meet the USEPA-accepted guidelines for wellhead protection programs including delineation of recharge areas that are not adjacent to or surrounding the well but that contribute water to the ground water source. For surface water, the delineation

The first requirement for states is to develop source water assessment plans.

Source water assessments must delineate the boundaries of the area that contribute ground water and/or surface water and potential contaminants to the community water systems.

must include the entire watershed area upstream of all intakes or diversion structures, up to the state's borders. The land area within the delineation boundaries is known as the source water protection area.

The source water assessments must include a **contamination source inventory**. The inventory locates the facilities or land uses within the source water protection area that are potential sources of raw water contaminants regulated under the Safe Drinking Water Act. In addition, some source water assessments will inventory contaminants that are not federally regulated but which the state has determined are threats to public health. After the delineation and inventory of the source water protection area, a **susceptibility determination** must be developed to determine how prone the public water supply is to contamination from the identified significant threats.

The assessments must include a contamination source inventory and a susceptibility determination to establish how prone the public water supply is to contamination.

State approaches as identified in SWAPs vary considerably, particularly in how a state intends to conduct the assessments. There are three ways in which source water assessments can be completed.

- The state can choose to undertake and complete all source water assessments.
- The state can choose to delegate the responsibility of completing source water assessments to the drinking water permit holder and elect to provide technical and financial assistance only.
- The state can choose to complete assessments for a certain type of public water system and delegate the remaining assessments to the drinking water permit holder.

It is in the best interest of local governments to contact the agency with Safe Drinking Water Act responsibilities to determine the approach to be used in their state.

In the last approach, a state may focus on the assessment of larger systems because they serve more people and thus may pose a risk to a greater population. In addition, completion of large system source water assessments helps the state move more quickly toward meeting the national goal of 50 percent of the population receiving drinking water from systems with source water protection programs by the year 2005. In this scenario, smaller systems may be required to assume responsibility for developing their own source water assessments, possibly with funding assistance from the state.

An alternative scenario is also possible. A public drinking water system that serves over 50,000 customers, for example, could be responsible for developing its own source water assessment because large systems have more resources to develop source water assessments than do small systems. A state may choose to conduct the assessment for small public water systems due to local

financial constraints and increased need for assistance in determining the condition of their source waters.

States also have been given flexibility in how they can gather data or use existing information as the basis for source water assessments. The following strategies, used alone or in combination, are examples.

- Previous assessments that were conducted for public water systems as part of a wellhead protection program or a watershed protection approach may be adopted to satisfy all or some of the source water requirements.
- Existing information on source water threats can be used as long as it is based on general hydrology or hydrogeology data and land use patterns, or if it is based on information gathered for existing monitoring waiver programs or other monitoring data for specific systems. This approach eliminates costly and time-consuming data collection, but its accuracy is dependent on the quality of the existing information.
- Specific targets may be selected to guide the development of assessments. For instance, a particular type and size of public water system may be selected to target assessments or objectives for specific contaminant or potential problems can be identified.
- Assessments may be conducted for all systems using only available data and then detailed assessments would be developed for those systems that seem to require more precise analysis. As an alternative, an interim process may be selected whereby an assessment is conducted to provide an immediate benefit for a specific system and then a comprehensive assessment that meets the requirements would be undertaken later.

States generally administer other environmental laws that affect drinking water supplies, including those relating to wastewater collection, treatment, and discharge (e.g., Clean Water Act) and solid and hazardous waste management (e.g., Resource Conservation and Recovery Act). They also may administer programs relating to public education and involvement and provision of grants and/or loans to local governments. In addition, states are involved in research, planning, monitoring, and enforcement activities that relate to source water protection. Contact information for state environmental agencies and state drinking water offices is included in Appendix C.

Local Role

Local government programs may be regulated by federal and/or state agencies because they are direct service providers (i.e., they are often the permit holder that provides drinking water to their residents). Consequently, the role of local governments under the Safe Drinking Water Act, as well as with other environmental laws, differs considerably from the role of the federal and state governments. Historically, drinking water providers, including local governments, had to:

- have a reliable source of raw water;
- effectively withdraw and treat that water to drinking water standard; and
- distribute that water safely to residents.

In addition, locally implemented health-based standards were set for finished drinking water, monitoring was required, and penalties set for not meeting the standards. Further, training and certification programs were encouraged or required for local drinking water treatment plant operators so that they knew how to treat water to meet the standards.

Although these requirements remain in force under the Safe Drinking Water Act, the 1996 amendments place increased emphasis on controlling those activities within the designated protection area that can adversely affect drinking water sources. As a result, the role of local governments is shifting, in particular relating to controlling land use activities that can result in the contamination of drinking water supplies. Once the assessments are completed, it is expected that actions will be taken to minimize the potential sources of contamination. In addition to **corrective activities** that remove contamination threats, the role of local government includes **preventive actions** through land use planning and control programs to ensure that current and future land uses do not pose a threat to drinking water supplies.

Once assessments are completed, it is expected that actions will be taken to minimize the potential sources of contamination.

The first step for local governments is to communicate with their state water protection agency to determine who is responsible for conducting the source water assessment and what financial and technical resources are available. To assist local governments, the state may develop guidance on the role of local governments and/or permit holders in conducting source water assessments for community water systems. If a guidance document is not published by the state, the water protection agency may establish an office, helpline, or website to offer technical assistance. In addition, Appendix D provides detailed information on the general steps involved in conducting a source water assessment.

Developing a Local Source Water Protection Program

Regardless of who conducts the assessment, local governments need to plan how they will use the assessment information to protect their water supplies. Source water protection efforts may involve developing a formal source water protection plan or simply giving consideration to which protection tools best address priority threats and then using those tools to protect water supplies.

It is expected that the information and understanding needed to develop a source water protection program will be generated during the assessment process. The state and/or permit holder is required to develop maps at the appropriate scale and level of detail of the source water being

assessed. The maps must include the delineated area and sources of contamination. When requested, all of the information collected during each assessment must be made available to the public water system, the local government, and/or the general public.

Each local source water protection program will be unique due to the hydrogeologic characteristics of the drinking water source, the presence and type of threats in the vicinity of the water supply, and the commitment of the local residents and elected officials to address identified threats. The following steps, however, provide a general guide for developing a source water protection plan or for planning a source water protection program.

1. Know what approach the state is taking through contact and communication.
2. Identify local stakeholders and develop a process with opportunities for their meaningful involvement in planning protection strategies.
3. Consider the effect of local government policies and regulatory and nonregulatory decisions on the drinking water source.
4. Consider the existing policy and regulatory and nonregulatory activities that can be focused on source water protection:
 - review land use and health ordinances;
 - review nonregulatory measures; and
 - review federal, state, and local water protection programs and activities.
5. Develop a local source water protection plan/program that:
 - integrates and focuses the existing water protection options on source protection;
 - establishes new options needed for protecting the source;
 - links source water protection measures with the local master plan and/or comprehensive plan; and
 - describes who will do what.
6. Develop an emergency plan that describes what actions will be taken in the event a spill or release threatens to contaminate the drinking water source.
7. Establish a review process that involves:
 - monitoring the effectiveness of the protection actions;

- adapting the protection plan in light of monitoring information; and
- updating the source water assessments to include newly active community water systems, wells, or intakes and to consider changes in land use that could hinder protection of the drinking water source.

Summary

The 1996 Amendments to the Safe Drinking Water Act provide considerable flexibility in carrying out required source water assessments for community water supply systems. The role and responsibility of local governments in the assessment process will vary by state, depending on how the agency responsible for the safe drinking water program plans to carry out the assessments and set financing priorities. Regardless of the exact role of local governments in source water assessments, greater responsibility has been shifted to the local level to provide source water protection. It is critical, therefore, that local governments participate in the source water assessment process, even if the assessments are conducted by the state or by a permit holder other than the local government. It is also essential that local governments plan how they will respond to the identified potential threats to their drinking water supplies by thoughtfully considering what source water protection tools best address priority concerns.

PART II

The Source Water Protection Toolbox

Source Water Protection Tools

Threats to water supplies are diverse and to address them local officials will have to use all the means at their disposal.

Tim Navarre, Borough Assembly Member
Kenai Peninsula Borough, Alaska

Part II provides information on specific land use, wet weather runoff, public health, and nonregulatory tools that can be adopted in the development of a source water protection plan.

Table 1. Tools for Source Water Protection

| Protection Tools | Prevn- tive | Corre- tive | Regul- atory | Non- reg. | Surface Water | Ground Water |
|---|----------------|----------------|-----------------|--------------|------------------|-----------------|
| Stakeholder Involvement | X | X | | X | X | X |
| Land Use Tools | | | | | | |
| Zoning | X | | X | | X | X |
| Alternative zoning: Overlay districts, critical areas, buffer and setback zones, agricultural zoning, performance-based, cluster development, density standards, large-lots, transferable development rights, impact fees, development agreements | X | X | X | | X | X |
| Subdivision requirements: Site design, on-site wastewater, sediment & erosion control, dedicated areas, conservation subdivisions | X | | X | | X | X |
| Building codes: Building permit limitations, impervious surface, porous pavement, excavation, grading & seeding, phased development | X | | X | | X | |
| Wet Weather Runoff Tools | | | | | | |
| Federal storm water controls: Phase II NPDES Permit | X | X | X | X | X | X |
| Erosion and sedimentation ordinances: Nonstructural BMPs, Structural BMPs—Grass or vegetated swales, infiltration basins, runoff ponds & wetlands, nutrient loading standards | X | X | X | X | X | X |
| Intergovernmental coordination & agreements: Storm water collection infrastructure & treatment, floodplain preservation, consistency | X | X | | X | X | X |
| Public Health Tools | | | | | | |
| Contaminant-specific regulations: Use restrictions, handling requirements | X | | X | | X | X |
| Source-specific regulations: Design standards, on-site inspections, underground fuel storage, well installation permits, well closures, sewage discharge permits, septic tank regulations | X | X | X | | X | X |
| Nonregulatory Tools | | | | | | |
| Pollution prevention: Source reduction, management, disposal, education | X | | X | X | X | X |
| Site restoration: Nonintervention, partial, active, rehabilitation, re-siting | | X | X | X | X | X |
| Land acquisition: Purchase, conservation easements, donations | X | X | | X | X | X |
| Conservation & reuse: Public information campaigns, rates structures, development regulations, use restrictions, direct potable reuse, indirect potable reuse, indirect nonpotable reuse | X | X | X | X | X | X |
| Public education & awareness: The community systems, source water protection, individual actions, emergency management | X | X | | X | X | X |
| Emergency response planning | X | | X | X | X | X |
| Funding Tools | | | | | | |
| Drinking water state revolving fund | X | X | | X | X | X |
| Other federal/state funding tools | X | X | | X | X | X |
| Local funding tools: Taxes, rates & surcharges, bonds, surcharges, fees | X | X | X | | X | X |

The various protection measures discussed are offered as a toolbox of source water protection options that help prevent or minimize threats to drinking water supplies. Local governments are encouraged to select only those tools that will work best in their community and political situation.

Table 1 provides a quick list (in the left-hand column) of the tools in the source water protection toolbox. It gives information on the usefulness of the protection tools as preventive (i.e., actions that prevent future threats from occurring) or corrective (i.e., actions that correct existing threats to drinking water quality) control measures or both. The table also identifies the tools as regulatory or nonregulatory in nature and whether they apply to surface or ground water or both.

Stakeholder Involvement

Source water protection programs provide the opportunity to bring diverse partners together, to address community needs comprehensively and to protect water supplies long into the future.

Mary Powers, Commissioner
Kalamazoo County, Michigan

Public and private stakeholder involvement is a critical element in guiding the source water protection process. Many local governments already know the value of providing stakeholders with meaningful opportunities to participate. Some have found that stakeholders may be the most important protection “tool” in the box.

There are key opportunities for stakeholder groups to be involved in setting source water protection goals and strategies for reaching those goals. In many cases, threats to source water relate to actions taken or not taken by people living, working, and playing in the vicinity of the water source. Achieving commitment from citizens to protect their water supply is not necessarily an easy task, but it is essential for the success of an effective source water protection program. Consequently, it is important to plan carefully how to involve stakeholders in the process.

Local government officials are crucial to the success of the source water protection program for two reasons. Most often the community water system will be owned and operated by local governments but, even when this is not the case, most citizens will expect local government to respond to drinking water concerns. Both elected officials and staff representatives should be involved in the process because they may have different perspectives, insights, and information important for protecting source water. In addition, local governments should identify key stakeholders that represent, at a minimum, the following concerns.

- **Public water system personnel** have intimate knowledge of the water system, including expertise in the strengths and weaknesses of its infrastructure, the nuances of its day-to-day operations, and the regulatory requirements involved in producing drinking water. Experience with these considerations will be important in developing local assessments and protection programs.
- **Commercial and industrial National Pollution Discharge Elimination System (NPDES) permit holders** are another important stakeholder group with an interest in source water protection. Because NPDES permits authorize discharges to water bodies, this group represents sources of pollutants significant on a watershed level. The end-of-the-pipe nature of these pollutant sources makes it easier to monitor and control them and may provide opportunities for reducing watershed-wide pollutant loads through effluent trading or waste reduction.

- **Agriculture and forestry representatives** are important stakeholder groups in source water protection areas where these practices are undertaken. Agriculture and forestry practices can greatly affect the amount and quality of nonpoint source pollutants entering a water source, and therefore should be involved in seeking and implementing acceptable local protection measures.
- **Special interest groups** such as environmental organizations, watershed associations, civic associations, homebuilders, and realtors represent various viewpoints. Each group may have a unique interest in source water protection, which could result in creative and innovative local protection measures.
- **Customers and watershed residents** must not be overlooked as an important stakeholder group. Local constituents will be affected by the source water protection activities adopted by local government. However, residents can also greatly affect the success of the local program by supporting its adoption and by implementing individual protection measures.

The results of the source water assessments for each community water supply must be made available to the public. Therefore, stakeholders will have the information and the opportunity to help establish local protection goals. Local governments can enrich the source water protection program by seeking stakeholder input in identifying issues and concerns to determine overall management objectives. In addition, input can help develop a set of indicators to use in assessing potential threats and in measuring progress. The public also will be given the opportunity to review and comment on the state's annual Intended Use Plan, which sets source water project priorities by describing how federal funding will be administered. This is a key chance for stakeholders to elevate local source water protection concerns for funding consideration.

The results of the source water assessments for each community water supply must be made available to the public.

Stakeholders can also help local governments in designing an equitable and acceptable utility rate structure and provide advice on capital improvement programming. Other local activities that benefit from public involvement include the development of water conservation measures and an emergency plan to protect the source water supply from emergency situations. In addition, source water protection activities can be ideal community projects, providing residents with meaningful activities that can benefit their communities.

Local officials may want to consider choosing a structured process for stakeholders to use in helping to evaluate the overall protection strategy and to shape and direct the source water protection program. Each stakeholder process may be different depending on the community water supply goals, priority issues, political climate, regulatory context, nature of the water source, size of the source water protection area, and budget for protection measures. The process should describe the specific role of the stakeholder group (i.e., is it to be primarily an advisory body or is it to guide or steer the process). This may be influenced in part by the local government's involvement in

providing water services, the community's expectation to have a strong participatory role, and whether the local issues have a history of controversy and/or strong community involvement.

When considering which source water protection tools are most appropriate for the local situation, stakeholders can be directed to weigh factors such as:

- legal mandates;
- local authority/jurisdictional responsibility;
- magnitude and severity of potential threat;
- benefits of management options;
- control of and confidence in technological methods;
- reversibility of source contamination;
- restoration versus protection costs; and
- a safety factor influenced by the degree of uncertainty in the analysis.¹³

Involving stakeholders helps achieve commitment to source water protection. It builds public support and customer confidence and creates recommendations that are more likely to be adopted. Commitment from stakeholders can lead to better, more cost-effective decisions and form stronger working relationships among those affecting or affected by drinking water supplies. The local partnership approach has proven to be a successful way to achieve better response, motivation, and cooperation within a community.

In addition, local partnerships and local commitment help support cooperative work between neighboring communities to protect shared water supplies.¹⁴

Involving stakeholders helps achieve commitment to source water protection.

Land Use Tools

A more compact pattern of development reduces land consumption, preserves farmland, reduces fragmentation of open space, protects natural and historic resources, and creates a more efficient method of service ... as well as reducing the cost of providing infrastructure and public services.

Robert S. Weiner, Councilman
New Castle County, Delaware

Zoning ordinances, subdivision regulations, and building codes are traditional and widely used land use measures that can be designed to protect surface and ground water sources. Alternative zoning tools also have been designed to provide flexibility to develop in more environmentally sensitive ways according to the opportunities and constraints of specific land parcels. Often, using these alternative tools is the most effective way to protect drinking water supplies. While some of the source water protection tools offered in this section are not regulatory, effective implementation of land use authority to protect water supplies requires that local officials examine their land use programs to determine whether changes should be made. In addition, some land use control measures are more effective in preventing potential water supply threats from being sited in the source water protection area than they are in addressing land use activities that are already in place.

Zoning

The zoning ordinance is the basic legal instrument traditionally used by local governments to address land use matters. A zoning ordinance divides land into districts, allowing compatible land uses to exist in each district but separating incompatible uses from each other. It consists of a map showing the various districts that permit residential, commercial, industrial, agricultural, and other uses. The ordinance also includes a written portion that establishes the conditions under which land may be developed and used for particular purposes, such as the allowable size and height of structures, building density, setback requirements, and other conditions for each district. These conditions often include restrictions on the siting of specific facilities or activities that are potential sources of contamination. Potential contaminant sources that may merit siting restrictions include landfills; wastewater treatment plants; business concerns that store, use, or process hazardous materials or contaminants of concern; and large concentrated animal feeding operations.

A variety of zoning tools can be used by local governments to protect surface and ground water sources by prohibiting activities or land uses that present risk of contamination in source water protection areas.

Alternative Zoning Tools

There are various types of alternative zoning tools used by local governments to protect surface and ground water sources. These tools are usually implemented through local ordinances, but some require state enabling legislation. Alternative zoning tools may prohibit activities or land uses that present a risk of contamination in source water protection areas, establish performance-based or financially based protection measures, or require a permit or contractual agreement to conduct certain activities.

- **Overlay districts** establish areas where additional zoning restrictions apply that are superimposed on top of the underlying type of zoning. Land uses in overlay districts must then conform to the restrictions set for both zones. This approach can be used to identify and set additional protective measures for water supply watersheds, wellhead protection areas, floodplains, wetlands, and significant ground water recharge areas.
- **Critical area zoning** is similar to the use of overlay districts in that it imposes restrictions or prohibitions, or requires review standards for developments in water supply watersheds, areas with steep slopes, floodplains, wellhead protection zones, significant ground water recharge areas, and similar sensitive areas. It often allows for nonintensive uses such as some types of agriculture or recreation fields that preserve the water quality functions of the land (e.g., floodplains that filter water pollutants). Critical area zoning can be a powerful tool to protect highly vulnerable portions of the source water protection area.
- **Buffer and setback zones**, a specific type of critical area zoning, designate linear or circular areas of land along the edge of a stream, river, or reservoir upstream of a community water supply intake. They are important protection mechanisms since land use restrictions in the zones can reduce the adverse impacts of surface water runoff on drinking water sources. Buffers and setbacks provide water quality protection by filtering the over ground sheetflow of rain or snowmelt that transports contaminants from land to water supplies and provides greater opportunity for it to soak into the soil. Buffers and setbacks can also provide other functions, such as minimizing flooding, preserving wildlife habitat and corridors, maintaining stream bank integrity, protecting aquatic habitat, and providing recreation areas. The most effective buffers and setbacks are naturally vegetated and undisturbed strips of land 50 to 400 feet in width. Exact determination of the width is flexible, based on such factors as topography and slope, classification of the stream or water body, current and future land uses in the watershed, costs, and political realities.
- **Agricultural zoning** prohibits nonfarm residential uses to protect areas from development pressures by limiting the extension of public facilities only to those lands that are more suitable for development. It prevents speculative escalation of land values, alleviating the economic pressures on farmers to convert their land to more intensive uses. This approach can help reduce threats to water quality by limiting the urbanization of critical areas in a watershed. If this mechanism is to be used, however, allowable agricultural uses within the zone should be reviewed to ensure that they do not pose a threat to the water supply.

- **Performance-based zoning** involves an impact assessment approach to determine the limitations of the land's ability to handle the proposed development and/or to set design standards to be met by the potential land uses. Proposed developments must meet the stipulated restrictions or standards that can be based on sewage capacity, acceptable volume of surface water runoff, or other relevant factors established for the area in which they wish to locate.
- **Cluster development** provides options for grouping units in a portion of the total development area. This tool can be implemented through **cluster zoning** or **planned unit developments** that maintain the overall density of the land parcel but provide flexibility in where the development occurs and what lands are left in more natural conditions. Benefits of cluster development can include surface and ground water protection, preservation of green space or other natural features, and economic savings by reducing capital outlay for roads, power lines, water lines, and sewer lines.
- **Density standards** can protect water quality by limiting the concentration of facilities or activities generating or handling contaminants that singularly or in limited numbers may be acceptable but that in large numbers threaten to pollute water supplies. Density standards can also increase the percentage of land kept in a natural condition that is able to absorb, filter, or immobilize pollutants.
- **Large-lot zoning** establishes a minimum lot size that can also provide water protection through the greater infiltration capacity of green space. Large-lot zoning, however, can increase impervious surfaces (e.g., roads) and infrastructure costs, and can contribute to urban sprawl. On a watershed-wide basis, large-lot zoning can be an important water management tool, but it must be weighed against other public policy concerns.
- **Transferable Development Rights** also allows flexible density transfers by designating sending and receiving zones in a community or in a watershed. This tool allows landowners in the sending zone to reap market value return for their land without actually converting it to its highest and best use. They do so by transferring the development rights of their property to property in the receiving zone that can then be developed more densely. In return, they are paid for giving up their development rights. This tool can keep land in an undeveloped state to protect the water resources in the sending zone or to preserve agricultural or open space amenities. In receiving zones developers can increase their profit by increasing density through the purchase of off-site development rights. Alternatively, development rights for critical areas may be purchased.
- **Impact fees** allow for the collection of money from new development applicants based on a formula that calculates the impacts on the natural resources and local infrastructure caused by the new development. The fee structure is typically established in a local ordinance codified within the zoning ordinance. The local government can apply the assessed fees to offset the impacts on water quality by, for instance, installing storm water infrastructure or acquiring critical land in the source water protection area. This regulatory protection tool may require state enabling legislation that authorizes local governments to enact and assess impact fees.

- **Development agreements** are binding legal contracts, usually between a landowner/developer and the local government, that specify how the parties believe the development project should be accomplished. The parties to the agreement negotiate permit conditions in exchange for public benefits such as protection of source water resources. This tool may be most useful in large, lengthy developments in which it is beneficial for all concerned that stable and predictable development will occur. Nine states have chosen to establish criteria for the use of development agreements in state enabling legislation.¹⁵ On a less formalized basis, local governments frequently negotiate *ad hoc* agreements with developers, which identify development restrictions, public benefits, or amenities as conditions for permit approval.

The specific alternative land use tools of value in any given situation will depend on state law, the types of land uses in the source water protection area, and the risks that they pose to the water supply.

Subdivision Requirements

Subdivision requirements are another traditional land use tool used to control the division of land into lots. They set standards for public improvements, which can be designed to protect community water systems and source water supplies. In addition to identifying water supply and wastewater management options, traditional subdivision regulations often specify the following requirements.

- **Site design, engineering, and construction** requirements establish standards for streets, curbs, gutters, and other drainage structures and for the use of impervious surfaces to protect water resources on- and off-site.
- **On-site wastewater and erosion and sedimentation control** requirements can be stipulated in subdivision requirements.
- **Dedicated area** requirements for ground water recharge or public amenities such as open space and parkland may also be established in subdivision requirements.

As with the alternatives to zoning tools, subdivision regulations are being adopted to protect natural resources. Many local governments are adopting subdivision ordinances to allow flexible development designs that are based on the natural features of the site, enabling the developer to protect stream corridors, wetlands, and other sensitive areas.

- **Conservation subdivision** ordinances are similar to performance-based zoning in that they enable the developer to concentrate development on suitable parts of the land parcel, resulting in less impervious surface, reduced infrastructure costs, and better source water protection. This tool can direct the set-aside of a percentage of the development in a natural state, targeting the protection of sensitive areas.

Building Codes

Building codes are a traditional regulatory tool that can be used by local governments to protect the health, safety, and welfare of their citizens. Some building codes may be required by the state and must meet state standards, while others address local concerns and can be adapted to address local needs and meet local requirements. Reasons to adopt building codes include:

- protecting health through construction standards such as weather-tight structures,
- preventing fires,
- encouraging sound, steady growth, and
- maintaining funding eligibility for some types of grant assistance.

Some aspects of building codes may be mandatory, such as electrical, plumbing, gas, and fire prevention, while other aspects are permissive, such as requirements relating to historic preservation, swimming pools, excavation and grading, and impervious surfaces. Building codes that can be used as tools to protect source water include the following:

- **Building permit limitations** are quotas on the number of permits issued in a specified time period or within a specified geographic area to limit the type, timing, distribution, or total amount of new construction. Such limitations are most commonly used to ensure that development and infrastructure expansion occur simultaneously.
- **Impervious surface** building codes control the proportion of a building site that can be covered in nonporous roads, roofs, parking lots, driveways, sidewalks, and other pavements without capturing and/or treating the runoff. This code limits the generation of runoff and the pollutants it carries at the source, while allowing development of any type and intensity to occur.¹⁶
- **Porous pavement** codes require the use of specific materials such as permeable asphalt, concrete, and crushed stone or gravel; open-celled pavers such as concrete or plastic grids with voids that are filled with topsoil and seeded or filled with porous aggregate; grass; paving stones; and wood mulch. These materials can be used for street pavements, driveways, parking lots, sidewalks, bike and foot paths, pedestrian plazas, and courts where appropriate to increase the capture, infiltration, and treatment of runoff through the underlying soil.¹⁷
- **Excavation, grading, and seeding** codes can also affect the amount and quality of surface runoff that leaves a site during and after construction.
- **Phased development** codes can be adopted to affect the timing of land-disturbing activities on a building site. This protection measure requires that construction be completed to a stage where exposed land is stabilized before another section of the site is placed under construction. By minimizing the amount of exposed land to that under active construction, runoff can be diminished and controlled by vegetative cover.

If an area is undergoing rapid growth, local governments can use building codes as a tool to protect source water quality through a system of permits and inspection. The permits allow construction to be undertaken as long as the standards are followed and periodic inspections are made by the building or zoning inspector to ensure compliance.¹⁸

Building codes can protect source water quality through a system of permits and inspection.

Summary

Land use measures serve as critical tools for local governments to use in protecting their drinking water sources. It is essential, however, that land use measures, such as zoning, subdivision requirements, and building codes be developed and implemented in effective, legally defensible ways in order to protect source water quality. Consequently, local governments should consider the following Aground rules[®] when developing land use regulations, not only for protecting water supplies, but also for ensuring that the overall land use program is legally supportable.

- Does the power exist to regulate private property?
- Is the regulation (and the maps on which it is based) clear, or will it be voided for vagueness?
- Does the regulation comply with procedural due process requirements?
- Does the regulation comply with substantive due process requirements?
- Does the regulation violate the equal protection clause?
- Does the regulation unlawfully take private property without just compensation?¹⁹

In addition, to protect a community from expensive and lengthy litigation under a takings claim, local governments should consider the following.²⁰

- Regulations must be based on a comprehensive, land use, or other locally adopted plan.
- The purpose and intent of the regulation should be clearly spelled out in the local ordinance.
- The regulation must include a process that provides for variances, special exceptions, or administrative relief.
- The plans and regulations must be revised and updated on a regular basis.

Local governments that apply these principles to their land use control programs are less likely to have courts rule against them if litigation occurs and more likely to have the tools needed to protect source water supplies. In addition, legal counsel with special knowledge of land use law is a necessary component of any land use control program.

Wet Weather Runoff Tools

Effective source water protection requires a multi-pronged approach including regional cooperation, land use controls based on technical studies, appropriate storm water management, and the political will to make it all happen. By being proactive with reasonable restrictions, we can assure an adequate supply of safe drinking water for future generations.

Ellen Reckhow, Commissioner
Durham County, North Carolina

Wet weather runoff can affect water supplies through both storm water flows and erosion and sedimentation. It is difficult to separate the two because both refer to the washing of pollutants, debris, dirt, and/or excess water from land into waterways. Storm water typically involves the collection of wet weather runoff and its discharge either directly into a waterway or into a sanitary sewer system. Erosion and sedimentation, however, solely involves the movement of water and soil across land in a nonpoint sheetflow, although gullies or channels often form.

Nevertheless, both storm water runoff and erosion and sedimentation are driven by storm events or sometimes even minor rain or snowmelt that, due to human activities, change the amount, speed, and/or water quality of runoff. Both are threats to water quality from a variety of activities and conditions: forestry, agriculture, land-disturbing development, lawn care, and the conversion of natural areas into impervious surfaces such as streets, driveways, roofs, and parking lots. Storm water runoff and erosion and sedimentation are considered the leading cause of water pollution today.

Historically, local governments have dealt with wet weather runoff by diverting storm flows and by restricting development in floodplains. To effectively control the amount, speed, and water quality of runoff, a combination of storm water management and erosion and sedimentation control options are required. Increasingly, wet weather runoff is being controlled through federal regulations that require storm water permits, while erosion and sedimentation is typically controlled through local ordinances. Local ordinances sometimes specify mandatory best management practices (BMPs) to control runoff, but frequently the implementation of BMPs is a voluntary, nonregulatory approach to achieve source water protection.

Wet weather runoff is becoming increasingly important because of its contamination potential and because many local governments are beginning to consider storm water runoff as a potential source of drinking water that requires more effective management than diversion. Control of wet weather runoff is complicated, lending itself to the use of an integrated strategy to protect drinking water sources.

Wet weather runoff is increasingly important because of its contamination potential and ...

Integrated strategies often involve neighboring jurisdictions in the watershed. Intergovernmental cooperation and agreements are the most feasible way to achieve multi-jurisdictional watershed-wide source water protection.

... many consider storm water runoff as a potential drinking water source.

Federal Storm Water Controls

The rainwater or snowmelt that runs off city streets, parking lots, and construction sites can wash high concentrations of sediment, oil, grease, salt, pesticides, fertilizers, pathogens, litter, debris, and other pollutants into storm water drains, from which it is often discharged untreated into streams and waterways.²¹ In addition, storm water runoff can wash industrial and commercial contaminants such as solvents into the water system. The USEPA considers storm water runoff as the leading threat to public health and the environment today.²²

Storm water management merits emphasis because it is an increasing concern to local government due to several factors.

- As a community grows and more vegetated areas become covered by impervious surfaces, controlling the amount and speed of storm water runoff becomes harder and more expensive.
- Once an area has more than 10 to 12 percent of its land area covered by impervious surfaces, water quality will begin to deteriorate. If the impervious cover reaches 25 percent, structural measures to protect water quality are generally necessary.
- Storm water runoff can create chronic flash flooding that threatens lives and property.
- Increasing storm water volume in urbanized areas correlates with greater concentrations of contaminants in the runoff, which threatens source water quality.
- The volume and speed of storm water runoff can be attributable to and/or exacerbated by upstream jurisdictions.
- New federal regulations extend the requirement for storm water permits to smaller communities.

Due to the water quality impairments linked to storm water runoff, the USEPA is imposing new Clean Water Act permit requirements. The Storm Water Phase I Rule, implemented in 1990, requires a National Pollutant Discharge Elimination System (NPDES) permit for municipal storm sewer systems serving populations over 100,000, construction sites greater than five acres in size, and industrial activities. Starting in early 2003, the Storm Water Phase II Rule expands the NPDES permit requirement to owners and operators of municipal storm sewer systems serving populations under

Due to the water quality impairments linked to storm water runoff, the USEPA is imposing new Clean Water Act permit requirements.

100,000 located in urbanized areas (as defined by the Bureau of the Census), resulting in storm water controls for approximately 5,040 additional local governments across the country. In addition, operators of construction sites disturbing one to five acres will be required to obtain an NPDES permit. This additional coverage is estimated to ensure that sediment from more than 97 percent of the land disturbed by construction activity will be controlled under a Phase II storm water permit.²³

Most of the municipal storm sewer systems and construction applicants will be covered under a general rather than an individual permit, but they will be required to implement storm water management programs and practices to reduce the discharge of polluted storm water runoff. The **minimum control measures required for Phase II NPDES permits** include:

- public education and outreach;
- public involvement and participation;
- illicit discharge detection and elimination;
- construction site storm water discharge control;
- post-construction storm water management; and
- pollution prevention at municipal operations.

Erosion and Sedimentation Ordinances

Erosion and sedimentation ordinances are another option to control the adverse impact of storm water runoff and erosion and sedimentation. Land-disturbing activities associated with construction, forestry, and agricultural operations promote erosion and sedimentation because the exposed soil is vulnerable to being carried off the site during rain events or snowmelts. The USEPA estimates that runoff from construction sites carries sediment at a rate of between 20 and 150 tons/acre/year.²⁴ Contaminants typically adhere to soil particles so sediment carries chemical and nutrient pollutants from land to water. Erosion and sedimentation have been identified as the single largest cause of impaired water quality in rivers and the third largest cause of impaired water quality in lakes.²⁵

Contaminants typically adhere to soil particles so sediment carries chemical and nutrient pollutants from land to water.

Erosion and sedimentation control ordinances often specify the use of best management practices (BMPs) to minimize the impact of land use changes and other human activity on the natural environment. The goals of using BMPs for land-disturbing activities are to:

- effectively reduce the amount or volume of runoff leaving a site;
- prevent the discharge of pollutants into the source water system; and
- reduce the impact of the runoff on water quality by improving the chemistry of the runoff.

Some BMPs may be requirements specified in an ordinance, while others may be voluntary practices, the selection of which is left to the landowner or developer. Each state has an environmental agency that provides guidance on required and voluntary BMPs to control erosion and sedimentation and storm water runoff (see Appendix E). Many produce a document that serves as the state manual for land-disturbing activities and which can be the basis for the development of local erosion and sediment control and storm water management standards.

There are two broad categories of BMPs, those that pertain to nonstructural practices and those that involve the implementation of structural systems.

Nonstructural BMPs

Nonstructural BMPs specify certain procedures or emphasize education and outreach activities that reduce runoff and its impact through changing individual behavior. Such nonstructural BMPs include pollution prevention, developing emergency plans for accidents, and environmentally responsible land management. Construction practices may specify BMPs such as filter fences, storm drain inlet protections, and mulching and seeding of exposed land areas.

Structural BMPs

Structural BMPs are controls designed and constructed to minimize the adverse impact of storm water runoff and erosion and sedimentation.²⁶ They may include the following.

- **Grass or vegetated drainage swales** are open and nonerosive conveyance systems that replace gutters, drainage pipes, and paved channels to carry, treat, and facilitate infiltration of runoff from storm events or snowmelt. While runoff passes through the grass swales, the pollutants it carries have a chance to be removed by the vegetation.²⁷
- **Infiltration basins** are a system of shallow ponds connected by grass or vegetated drainage swales. The gradient of the swales and the elevation of the ponds are constructed to control the runoff flow velocity to permit continuous ponding along the length of the infiltration system. However, the ponding is intended to be for a temporary duration of about 24 hours so that runoff is absorbed into the soil along the length of the system. Because the infiltration system is designed to be nonerosive, to treat runoff contaminants, and to absorb the water, the swales and basins are effective at protecting source water from runoff.²⁸
- **Runoff ponds and constructed wetlands** are larger and deeper than shallow infiltration basins. They can act as a pretreatment system that allows the settling and filtration of runoff. These

systems are particularly useful in controlling peak flows during large, rare storm events. In addition, they are also useful if the topography does not permit the vegetated swale and shallow ponding system. If the low velocity of the infiltration system cannot be met, numerous check dams of earth, wood, or stone can help slow runoff to storm water ponds and constructed wetlands and improve treatment performance.²⁹

- **Nutrient loading standards** can establish the permissible amount and source of nutrients in runoff and the amount, source, placement, and timing of nutrient applications on the landscape. Nutrient loading standards are often implemented in nutrient management plans and include manure, organic wastes, chemical fertilizers, and crop residue sources.³⁰

In addition, structural BMPs may include some of the practices discussed under building codes, such as limits to impervious surfaces, use of porous pavement, excavation and grading requirements, and phased development.

Intergovernmental Coordination and Agreements

As previously mentioned, wet weather runoff can often originate from and/or be exacerbated by upstream jurisdictions. Effective control of wet weather runoff, whether it is for permit compliance, drinking water quality, flood control, or management as a drinking water source, requires consideration of the entire watershed. It may not be possible to make an upstream neighbor control runoff in their jurisdiction. However, through intergovernmental coordination and agreements it is often possible to develop a cooperative approach to managing wet weather runoff events on a watershed basis.

The following are just a few of the many runoff control approaches that are suitable for intergovernmental coordination.

- **Storm water collection infrastructure and treatment facilities** may be required by the new Phase II NPDES permits. Depending on the degree of urbanization within a watershed, at least one watershed government may need to install, operate, and maintain storm drainage infrastructure and facilities. It only makes sense to consider runoff inputs from the entire watershed when designing these facilities.
- **Floodplain preservation** in a naturally vegetated state will be particularly important watershed-wide. This can be accomplished through intergovernmental agreements that establish floodplain management zoning and/or buffer and setback zones, as previously described.
- **Consistency** in local government land use measures, erosion and sedimentation ordinances, and enforcement efforts throughout the watershed will be critical in order to succeed in watershed-wide source water protection. As most ordinances attempt to achieve similar results, consistency between local government ordinances may be a larger concern for the legal counsel than for the public or elected officials.

Summary

Controlling wet weather runoff and the contaminants it carries is increasingly complicated and expensive. Although it is not always easy to achieve intergovernmental coordination and formal or informal agreement, the long-term benefit in terms of source water protection, cost-efficiency, and good relations, make it worth the effort. It must be emphasized, however, that intergovernmental coordination and agreements can be as important to the effectiveness of other source water protection tools as it is when using wet weather control tools. Source water protection ultimately is about reducing, eliminating, or correcting contamination threats in the entire watershed, an effort that often involves more than one jurisdiction.

Public Health Tools

When water resources are compromised, the lives of citizens are threatened. Proper management of these resources is of vital importance to all communities and essential to the wellbeing of present and future generations.

Curtis Tyler, Commissioner
Hawaii County, Hawaii

The Safe Drinking Water Act is, at its core, a public health law rather than an environmental law. The focus of the law is to protect publicly supplied drinking water consumers from water-borne diseases, chemical contaminants, and radiation. To accomplish this task, national drinking water quality standards (maximum contaminant levels or MCLs) have been developed for nearly 80 contaminants (see Appendix A).

The Safe Drinking Water Act is, at its core, a public health law rather than an environmental law.

As efforts shift from only treating raw water to meet drinking water quality standards to protecting water sources from contamination, a greater emphasis on environmental protection emerges. Because of this increased environmental emphasis, a question is raised regarding the role of local government public health organizations (boards, agencies, etc.) in protecting drinking water quality. Does the shift to source water protection alter the traditional role of these local health organizations relating to drinking water? This is not an easy question to answer due to significant variation across the United States in the mission, authority, and capacity of these organizations. The situation is made more complex because water-related public health activities might be assigned to other local government agencies, including public works and environmental management.

Health regulations, however, have been in use since the settlement of the nation to protect residents' health, safety, and welfare. State and local governments have used health regulations as a traditional regulatory tool to manage and protect water sources. The local governing body usually establishes health regulations through adoption of local ordinances. As such, health regulations supplement other local ordinances, such as zoning and subdivision regulations, but may provide greater water quality protection because they can be tailored to specific contaminants or sources of contamination. Once the potential sources or types of contaminants are identified, a determination can be made as to whether health regulations are the best way to proceed.

Contaminant-Specific Health Regulations

Because the national standards for drinking water were established under the Safe Drinking Water Act, the role of local health organizations in establishing contaminant-specific requirements was greatly reduced. However, local health organizations have considerable leeway in addressing local health-related issues. If the local health officials determine that a threat to human health exists, they can take action. It is possible that contaminants for which an MCL has not been established could affect the local water supply. In such cases, the local government may adopt regulations specific to this source. For instance, if permitted by state law, health regulations could:

- **restrict the use** of certain potential contamination sources in source water protection areas (e.g., storage tanks, stock piles, septic tank cleaners); and/or
- establish **requirements for handling** toxic and hazardous materials within source water protection areas to reduce the risk of spill-related contamination of water supplies.

Source-Specific Health Regulations

Although local governments can adopt ordinances to protect public health from specific contaminants, typically health ordinances are adopted to protect source water supplies from potential contamination sources such as septic systems or on-site sewage management systems, underground storage tanks, toxic and hazardous materials handling and disposal facilities, and abandoned wells.³¹ More recently, local health regulations have been used in states such as Iowa and North Carolina in unsuccessful attempts to stop the siting of large animal feeding operations, in part to protect local water supplies.³²

The following are some ways that local health regulations can be used to protect source water supplies.³³

- Health regulations often establish **design standards** for potential contamination sources and require **on-site inspection** of construction and operation activities to ensure that they do not threaten water resources. Activities that are often subject to such requirements include: underground storage tanks, wells, septic tanks, and other on-site sewage disposal systems. In addition, ground water monitoring may be required for developments that include these activities or that involve the handling, storage, or generation of hazardous materials.
- If authorized by state law, health regulations may set **underground fuel storage requirements** such as secondary tank containment and periodic testing and monitoring to minimize the risk of leaks and spills. The regulations may also completely prohibit the use of underground fuel storage tanks in source water protection areas.
- Health regulations often require a **permit for the installation of wells** to ensure their proper placement and construction. Regulations may apply to specific types of wells (e.g., shallow

wells for private use) or to well installation procedures to prevent surface-level contamination from reaching ground water.

- **Protective well closure requirements** may be adopted to ensure that abandoned wells do not become a potential source of ground water contamination.
- **Sewage discharge permits** often provide siting and design criteria and maintenance and monitoring requirements for small sewage treatment systems. Regulations may also prohibit the use of on-site sewage management systems in cases where existing contaminant concentrations, such as nitrogen, pose a health risk.
- **Septic tank regulations** usually establish design and construction standards, require on-site inspection and percolation tests (to determine the absorption capacity of the soil at the site), establish density limitations on the number of septic tanks in an area, and set distance requirements between septic systems and wells and property lines. Local health regulations may also require that older septic systems be upgraded and that all systems be pumped regularly, such as every five years.

Summary

Most local governments, depending on the authority granted to them by state law, have considerable flexibility to use health regulations to protect water sources. The types of requirements that would be most effective in a specific situation depend on the nature of the water source; the activities, land uses, and facilities in the watershed; and the risks that those activities, land uses, and facilities pose to the water source. Certainly, once the source water assessment is completed and susceptibility determinations are made, local officials should review their health ordinances to determine whether they should be altered to better protect the community's water source(s).

Most local governments, depending on the authority granted to them by state law, have considerable flexibility to use health regulations to protect water sources.

Nonregulatory Tools

Local governments are critical partners and our stewards in preserving our sources of drinking water and ensuring public health protection for future generations.

John H. Hankinson, Jr.,
USEPA Regional Administrator
Region 4 (Southeast United States)

It may not always be possible for the owner/operator of a community water system to implement protection measures on the sources of pollution identified in the source water assessment. In these instances source water protection may best be accomplished through nonregulatory approaches. Nonregulatory approaches include pollution prevention, land acquisition, restoration of contaminated sites and water supplies, water conservation and reuse, public education and awareness, and emergency response planning.

Pollution Prevention

Pollution prevention should be a major theme of the source water protection program, because it is often easier and cheaper to prevent source water pollution than it is to clean it up after the fact. The financial cost of cleaning up a contaminated water supply can be exorbitant, and the cost to public health and the environment can be incalculable. Proper site management and good pollution prevention practices can avoid costly cleanup and liability issues. Therefore, protecting source water supplies through pollution prevention measures is becoming more a necessity than an option for local governments.

Pollution prevention should be a major theme of the source water protection program; it is often easier and cheaper to prevent source water pollution than it is to clean it up after the fact.

Pollution prevention related to source water protection includes activities that reduce the generation or release of hazardous substances and other contaminants.

- **Source reduction** is the most effective pollution prevention measure because potential contaminants are either not used or used at a reduced level. The threat of contamination, therefore, is reduced. Examples of source reduction activities include education programs to help homeowners reduce the application of fertilizers and pesticides, the modification of industrial practices to use less or reuse toxic materials, and integrated pesticide management programs used on golf courses and agricultural fields.

- **Management** of contaminants and polluting behaviors may include protocols and practices for wastewater treatment plants, septic systems, and storm water control; standards for storing hazardous substances, petroleum products, pesticides, and fertilizers; or programs to cap or plug abandoned wells.
- **Disposal** activities are related to the long-term fate of solid and hazardous waste, including household hazardous waste. Inappropriate siting and operation of disposal facilities can have a significant impact on water sources. Local government activities may also include hazardous waste amnesty collection days that allow residents to bring hazardous materials to a central location for collection and subsequent controlled disposal.
- **Education** can stress pollution prevention as a part of source reduction, management, and disposal efforts. Education measures may involve a public information campaign focusing on storm drains, maintaining shoreline and stream-side vegetative buffers, appropriate use of fertilizers and pesticides, boat and lawn mower engine maintenance, and household hazardous materials handling and disposal. Education may be coupled with technical assistance focused on developing the technical, financial, and managerial capacity of the community water system to comply with drinking water standards. Such an approach includes training for water system operators under a certification program.

Pollution prevention through land use tools, wet weather runoff control tools, public health tools, and other nonregulatory tools is by far the safest, cheapest, and most acceptable form of source water protection.

Site Restoration

Although pollution prevention is preferred, at times source water protection may be accomplished only through restoration of critical stream segments and watershed areas to a former natural condition. Restoration includes a variety of actions that help correct problems resulting from current and past land use practices. Some restoration activities can be managed at the local level using nonregulatory approaches, while others may involve a state or national program (e.g., restoration of superfund sites). Because this guidebook focuses on local protection tools, restoration is included as a nonregulatory approach to source water protection.

At times, source water protection will be best accomplished through restoration of critical stream segments and watershed areas to a former natural condition.

Restoration actions range from passive strategies to active site rehabilitation and include:

- **nonintervention** approaches that remove the contaminating facility or activity and allow the source water to recover on its own;

- **partial** approaches in which actions, such as BMPs, simply assist or speed-up the natural recovery that is under way; and **active** approaches that involve the installation of measures to restore the hydrogeologic structure and function of the source water.³⁴

Regardless of the strategy, the first step in restoration is to stop the impact of the activity or condition that impairs or threatens to contaminate the source water quality. This may involve **rehabilitation** of industrial sites through a USEPA-sponsored brownfields program or cleanup of underground storage tanks (UST) through a federal UST trust fund. Or restoration may require the **re-siting** or moving of certain facilities or operations because the characteristics of the contaminants that are used or stored there simply pose too great a risk.

The first step in restoration is to stop the impact of the activity or condition that impairs or threatens to contaminate the source water quality.

While perhaps not the easiest option, re-siting some facilities or land uses outside critical areas in the source water protection area may be the cheapest and best option for protecting the water source. Although land acquisition costs may be associated with re-siting, the long-term cost of instituting the highly technical and engineered solutions involved in the active restoration approaches may make reclaiming a drinking water source infeasible.

Land Acquisition

The acquisition of land or interest in land (e.g., conservation easements or purchase of development rights) that provides protective buffers around reservoirs, priority stream segments, wetlands, and other critical areas within the source water protection area is a very effective method to protect source water quality. Ownership of key land areas allows a community to prohibit or control activities that could impair drinking water quality. In addition to the pollution prevention and restoration values received from owning the land, it can also provide other benefits to the community, such as preserving wildlife habitat, providing recreational opportunities, and reducing flood damage.

Ownership of key land areas allows a community to prohibit or control activities that could impair drinking water quality.

Communities can target and acquire land parcels themselves, or they can work with other groups to protect land. Local and regional land trusts are independent nonprofit organizations formed to accomplish resource protection goals. Land trusts have successfully worked with local governments to protect drinking water sources by acquiring land within wellhead protection areas and in critical areas of water supply watersheds.

There are three general methods for land acquisition that local governments or land trusts, alone or in partnership, can undertake.

- **Land can be purchased** outright by the community or a land trust. Outright purchase can be accomplished at the fair market value of the property or possibly at a bargain price. The amount paid for land purchases may depend on the location of the parcel, the skills of the negotiator, and the conservation intent of seller.
- **Conservation easements** are used to separate development rights from a piece of property. For example, the community or land trust might identify the floodplain corridor of a drinking water supply as critical to remain in a natural state to achieve source water protection goals. The local government may acquire a conservation easement for the floodplain by purchasing the landowner's right to develop, clear, or otherwise alter the corridor but leaving ownership of the land to the individual. Conservation easements can be either purchased or received as a donation.
- **Land and conservation easements can be donated** to either the local government or a land trust, usually providing some tax benefit to the donor. The local government can encourage such donations by contacting potential donors and providing incentives for them to donate land. It is important, however, that the local government or land trust has prioritized the parcels of land that will contribute to the source water protection goal, enabling them to decline offers of parcels that are unwanted or have little source water protection value.

A funding option, the Drinking Water State Revolving Loan Fund, has been made available as part of the national source water protection program to acquire land and conservation easements. (This and other funding options are discussed in detail in the next section). To qualify for funding under this program, however, the property must be identified in an approved state plan as contributing to the protection of the drinking water source. Local governments, water suppliers, and land trusts can work in partnership to identify and acquire key land holdings from willing sellers. Each of these groups may have special knowledge of and expertise in identifying properties that will support the source water protection goals and will qualify for the funding.

In addition, local land trusts often have personnel with expertise in negotiating acquisitions. Further, it is common for communities and land trusts to cooperatively work through the financial and legal aspects of acquisitions. For instance, one or the other may purchase the land depending on financial flexibility and benefit to the donor. The land may then be permanently deeded to either party depending on the long-term goals of the community and the land trust and the capacity to care for the land.

Conservation and Reuse

Often the quality of the drinking water can be directly linked to the amount of water in the drinking water source (water quantity). For example, the more water in a surface water supply, the greater its potential to assimilate and dilute contaminants during spills, depending on the characteristics of the pollutant. The more water that remains in an aquifer, the greater its potential

to prevent the inflow of surface water or the intrusion of pollutants such as saltwater. Therefore, the amount of water that is used at the local level can affect the quality of local supplies.

The volume of water remaining in source water supplies at any one time can be affected by reducing water demand. Local government can manage water supply demand through conservation activities and by replenishing water supplies through water reuse, thereby protecting the source water supply for drinking water use. Conservation can be achieved through a variety of local government actions.

- **A public information campaign** and provision of technical assistance can be initiated to promote water-conserving practices, provide low-flow fixtures, and offer water audits to homes and businesses so they can reduce their demands on the drinking water source.
- **Local governments or water suppliers can price water** to reflect the full cost of securing, protecting, treating, and distributing water to residents.
- **Development regulations** can be adopted that require or encourage the preservation of native vegetation adapted to normal rainfall conditions and/or that require the use of xeriscape landscaping to help manage the demand on water supplies.
- **Water use restrictions**, either voluntary or mandatory, are the firmest form of water conservation measures. They are generally applied during droughts and other unusual circumstances.

The reuse of highly treated wastewater as a water supply has been implemented successfully in many areas. Practicing wastewater reuse can create what some consider to be a new water supply. Rather than discharging treated effluent to surface waters, water can be reclaimed for a number of uses to help protect the quality and supply of the drinking water source.

- **Direct potable reuse** is reclaimed wastewater, treated at the highest level, that is fed directly into the drinking water treatment systems.
- **Indirect potable reuse** is reclaimed wastewater that is discharged to a surface water body or to an aquifer for subsequent withdrawal as a drinking water supply.
- **Indirect nonpotable reuse** is reclaimed wastewater used for agricultural irrigation, landscape irrigation, industrial processes, or for other nondrinking water uses.

The connection between water quantity and water quality cannot be overstated. Although considering water quantity issues when planning for water quality protection may seem complicated, in the long run it can make source water protection easier and cheaper.

**The connection
between water quan-
tity and water quality
cannot be overstated.**

Public Education and Awareness

Public awareness and education are essential source water protection tools. The annual Consumer Confidence Reports will begin to raise the public's awareness of the quality of the community drinking water as well as issues relative to its protection. The reports provide an excellent opportunity for community water system operators to conduct a parallel public education campaign. In addition to the required information on water quality, a high-profile campaign could develop a more environmentally literate public and enhance awareness of the following topics along with other local concerns.³⁵

Consumer Confidence Reports will begin to raise the public's awareness of the quality of the community drinking water as well as issues relative to its protection.

- **The community water and wastewater systems** education effort might identify:
 - who operates the community water system;
 - the ground water or surface water source that supplies drinking water;
 - the per capita water consumption, seasonal water use, and use by sector;
 - who operates the wastewater treatment system;
 - where and how the community discharges its wastewater;
 - the number of wastewater system users, including industrial users and any pre-treatment requirements; and
 - the difference between storm water systems and sanitary sewers.
- **Source Water Protection** education could describe:
 - why source water protection is important;
 - what the source water protection area includes and zones of protection if designated;
 - the importance of identifying threats before they become problems;
 - potential significant threats to the source water supply(s);
 - how protection options compare in terms of water quality, cost, and ability to develop;
 - remediation vs. prevention, available technology, and costs; and
 - any impacts to local property owners within the source water protection area.

- **Individual actions that support local protection** are important themes for source water protection, and might include:
 - why public input is important;
 - involvement opportunities for local citizens;
 - proper handling of household solvents and hazardous materials;
 - proper waste disposal and recycling opportunities;
 - proper septic system installation and maintenance;
 - proper closure of abandoned wells;
 - best management practices for the application of pesticides and fertilizers; and
 - water conservation practices for homes and industries.
- **Emergency management education** is another critically important subject on which the public should be informed. An education program could explain:
 - why emergency planning is important;
 - the hazardous materials that are transported on routes through the community; and
 - the community's emergency preparedness or emergency plan and disaster response procedures.

An education campaign can use multiple outlets for affecting public awareness, such as: utility bill inserts, newsletters, community forums and meetings, local government Internet sites, and newspaper and radio coverage. In addition, community groups can assist in promoting public awareness regarding drinking water protection efforts. For instance, many communities have benefited from a community group project that stencils water protection advice at storm drains, the mouths of culverts, drainage curb cuts, heads of swales, and other entries to the storm water drainage system. This type of project places a permanent stencil that identifies the inlet, its water protection purpose, and protection measures that need to be taken, like no dumping of motor oil or detergents into the system.³⁶ In addition, a public awareness campaign may encourage residents to become the eyes of the community by contacting local personnel through the use of a pollution hotline telephone number to respond to violations of protection measures.

Emergency Response Planning

It is important to develop an emergency plan to ensure timely and responsible response to natural disasters, accidents, or acts of vandalism that disrupt the delivery of safe drinking water. In emergency situations that threaten contamination or failure of the source water supply, the local

government should be prepared to provide an alternative drinking water supply, even if another entity or a private company usually provides this service.

The development of an emergency response plan should involve water utility personnel, local planning staff, local elected officials, and the local (or regional) emergency coordinator or official. Other key local representatives, such as police, fire, and medical personnel, need to be part of the **emergency response planning team** to ensure that emergency situations in the source water protection area receive priority attention in a coordinated manner. If an emergency response plan exists, the emergency planning team can review it and make needed updates based on the source water assessment information and the source water protection goals. The local plan should also be consistent with any state emergency agency standards and Federal Emergency Management Agency (FEMA) requirements.

In emergency situations, the local government should be prepared to provide an alternative drinking water supply, even if another entity or a private company usually provides this service.

The **emergency response plan** should answer the "What if?" type of questions that enable a water system to react thoughtfully to an emergency situation before it becomes a crisis. For example, the plan should outline responses to a series of questions related to emergency situations, such as, "What if a spill or leak caused a pool of contamination in close proximity to the water intake?" The following questions serve as a guide to developing proper emergency responses to that situation.³⁷

- Is the surface water intake or ground water well threatened?
- Is there an emergency response mechanism in place sufficient to contain the spill?
- Should you shut down the intake or well?
- Can you provide an alternative and safe supply of water for a short period of time until the threat has passed?
- Do you have the funding to pay for water via a tank truck for a short period of time?
- Is providing an alternative source of water an option?

In addition to planning for short-term emergencies, the emergency response plan should develop options to long-term or permanent contamination of the water supply source and disruption to the water supply service. In this case, where could a long-term alternative water supply source be located?

The Montana Source Water Protection Manual has identified the following as critical **elements for the development of an emergency response plan**:

- identification of possible disruption or contamination threats;
- designation of an emergency coordinator for the public water supply;
- equipment and material resources;
- procedures to shut down and isolate the threatened or contaminated well or intake from the distribution system;
- procedures to coordinate with county and state emergency response agencies;
- procedures to effectively communicate with water users;
- sources of emergency water for drinking and other household uses as well as sources of equipment to transport, disinfect, and distribute the water;
- procedures to decontaminate the distribution system and well or intake;
- sources of emergency funds and procedures for requesting and dispersing such funds; and
- replacement surface water intake or ground water well.³⁸

For both types of emergencies, short- and long-term, the emergency response plan could involve intergovernmental mutual aid agreements with neighboring jurisdictions for **emergency water supplies**. These discussions may go so far as to consider the merits of interconnecting water supply lines to ensure uninterrupted service in the event of contaminated source water supplies or other emergency events. Even if the physical interconnection of water lines and pumping facilities is cost prohibitive, local governments can enter agreements with other water systems to supply drinking water during emergencies. At a minimum, the emergency plan should contain a resource inventory that lists the equipment and expertise of adjacent jurisdictions or nearby water suppliers that could be made available in times of emergency.

A local emergency plan not only develops a comprehensive response to disasters and emergencies; it also promotes disaster prevention, planning, training, and public education. A plan that describes existing emergency services, support resources, emergency response, communication, alternative water supplies, remediation, emergency source development and review, and update procedures helps protect source water supplies from current and future threats. An emergency response plan supports local government efforts to supply safe and reliable drinking water to residents.

A local emergency plan develops a comprehensive response to disasters and promotes prevention, planning, training, and public education.

Summary

Nonregulatory measures are important in protecting drinking water sources. Such measures as pollution prevention, restoration of contaminated sites, acquisition of important parcels of land or interest in that land, water conservation and reuse, public education, and emergency planning all help to ensure that local water sources provide safe drinking water. They also provide opportunities for improving quality of life and involving citizens in meaningful activities that better their communities.

Funding Tools

Although the cost of protecting drinking water supplies may be high, it is more costly not to provide them with adequate protection.

Mary Kay Reich, Commissioner
Monroe County, Florida

Funding needs for source water protection may vary widely depending on a number of variables, including the nature of the water source, the risks associated with the potential or actual contamination sources, and the consumer base. From the federal perspective, source water protection is intended to be integrated into existing protection programs to reduce the need to establish a new funding channel, although some funds are available for a limited time through the new Drinking Water State Revolving Fund. However, the focus of this funding effort is on eliminating redundancies in source water protection by using existing protection programs, thereby reducing the need to fund repetitive efforts. Activities such as the **wellhead protection** and **sole source aquifer** programs, and **public water system monitoring waivers** and **treatment exemptions** will include protection efforts that do not need to be repeated.

Drinking Water State Revolving Fund

A drinking water funding program was authorized, for the first time, under the 1996 Safe Drinking Water Act amendments to help community water systems achieve and maintain compliance with drinking water requirements and to protect public health. Through the federal fiscal year 2003, \$9.6 billion was authorized under the Drinking Water State Revolving Fund for capitalization grants. The national Drinking Water Infrastructure Needs Survey, conducted every four years, is the basis for allocating a percentage of the annual Drinking Water State Revolving Fund (DWSRF) to eligible states. From these allotments, each state can provide low interest loans and other types of assistance to eligible community water systems to finance infrastructure costs.³⁹

A drinking water funding program was authorized, for the first time in 1996, to help community water systems achieve and maintain compliance with drinking water requirements and to protect public health.

States may apportion some of their DWSRF allotment to finance source water assessment and protection activities. The set-asides can be used in designated percentages toward four categories.

- Up to four percent can be used for DWSRF administrative expenses.

- Up to 10 percent can be used toward management of the state program.
- Up to two percent can be used for providing technical assistance to small public water systems that serve 10,000 or fewer customers.
- Up to 15 percent of the total annual capitalization grant can be used for local assistance and other state programs with a 10 percent limit on any one of five activities.⁴⁰

The primary focus of the funding is on the construction of drinking water infrastructure. Low interest loans can be used to fund projects such as the installation or upgrade of water treatment facilities; development or rehabilitation of drinking water sources; installation or upgrade of water storage infrastructure; and improvements to transmission or distribution systems. However, there is also a new emphasis on pollution prevention. States have the option, but are not required to set aside a portion of their capitalization grant to fund eligible programs such as source water protection activities, including source water assessments, drinking water system capacity development, and operator certification.⁴¹

The following five activity areas describe the types of programs that may be considered eligible for local assistance. They represent opportunities for financial support to local governments to implement source water protection that promotes compliance and protects public health.

1. **Acquiring land or conservation easements:** Public water systems may receive loan assistance to acquire land or conservation easements from a willing party. The property must be designated as an identified need in an approved state source water protection program. In addition, acquisition of the land or conservation easement should help protect the system's source water and ensure compliance with national drinking water standards.
2. **Voluntary, incentive-based source water quality protection partnership petitions:** The USEPA petition program is voluntary for states. It was formed to allow community water systems, local governments, or other entities to petition the state for technical assistance or financial help for water systems that are not in compliance. Under the petition program a partnership between the entities is established to reduce the presence of contaminants and to develop long-term water protection strategies. Community water systems are eligible to receive loan assistance for local source water protection partnerships only if the protection actions address contamination from pathogens or chemicals in levels that exceed drinking water standards.
3. **Wellhead Protection Programs:** States may make direct expenditures of their DWSRF to establish and implement an approved wellhead protection program.
4. **Capacity development:** Public water systems may be eligible to receive funding to implement a project as part of a state capacity development strategy that builds technical, managerial, or financial capabilities to achieve and maintain compliance.
5. **Source Water Protection Areas:** States can set aside up to 10 percent of their FY1997

capitalization grant to delineate and/or assess source water protection areas for public water systems.⁴² Although states had until September 30, 1998 to apply, they have four years in which to obligate this set aside. Depending on state funding activities, portions of the FY1997 capitalization grant may be available until 2002.⁴³

Each year states must decide what combination of project and set-aside activities they will fund and describe this decision in their annual Intended Use Plan (IUP). States have been advised to give priority to projects that address the most serious risk to human health, projects necessary to ensure compliance with drinking water standards, and systems that have the most need for financial assistance on a per household basis.⁴⁴ States, however, must make their project support and funding decisions available to the public through a stakeholder comment process while developing an IUP. In this manner, local governments, water systems, and citizens can take part in the required review and comment process to shape the state's funding priorities for local source water assessments and protection activities.

Other Federal/State Funding Tools

While there is some money available for source water protection and the annual IUP may be the most significant opportunity available to local government to affect the use of state discretionary money, other federal/state funding options may be more easily accessed for specific protection projects. There are many funding mechanisms that are administered by the federal government and awarded through state programs. Individual source water protection activities may be eligible for assistance under programs listed in Table 2.

Table 2. Summary of Funding Programs⁴⁵

| Grant Program | Purpose | Eligible Applicants | Award Amount | Matching Share |
|---|--|---|---|--|
| USEPA Drinking Water State Revolving Fund Set-asides | Loans for the acquisition of land or easements for source water protection or for implementation of source water protection measures, or direct assistance for wellhead protection programs. | | Up to 31% of the DWSRF capitalization grant may be used for set aside activities. | |
| USEPA Clean Water State Revolving Fund | To capitalize state loan funds for wastewater treatment facilities and other water quality management activities, including nonpoint source, estuary projects, and storm water and sewer overflow control. | The funds are used to make low interest loans to communities, individuals, and others for water-quality improvement activities. | Approx. \$3 billion in water quality projects annually. | No local match required. |
| USEPA 319 Grants (Nonpoint Source Implementation) | To implement nonpoint source projects, including installation of BMPs with applicability for source water assessment and protection. | States and local governments, Indian tribes, nonprofit organizations. | Formula grants to states. | Beneficiaries, except for tribes, are required to provide 40% match. |

| Grant Program | Purpose | Eligible Applicants | Award Amount | Matching Share |
|--|--|---|--|---|
| USEPA Public Water System Supervision Grants | To ensure public water system compliance with Safe Drinking Water Act (SDWA) requirements, including inventory of drinking water systems, technical assistance, sanitary surveys, data management, laboratory certification, enforcement, and emergency planning. | Grants to state and tribal agencies. | | |
| USEPA 106 Grants (Water Pollution Control Program Support) | To support the prevention and abatement of surface and ground water pollution from point and nonpoint sources including wellhead protection. | States, tribes and interstate water pollution control agencies. | | |
| USEPA Water Quality Cooperative Agreements (104(b)(3) Grants) | To support innovative demonstration projects for addressing storm water, combined sewer overflows, sludge, pretreatment, mining, animal feeding operations, and other pollution sources relating to the National Pollutant Discharge Elimination System (NPDES) program. This includes research, investigations, experiments, training, surveys, and studies related to the causes, effects, extent and prevention of pollution. | | | |
| USEPA Pollution Prevention Incentives for States (PPIS) | Demonstration projects of pollution prevention or infrastructure in a wide range of sectors. | State agencies & municipalities, federally recognized tribes, U.S. territories, & possessions. | Varies: Maximum amount is \$80,000. | 50% nonfederal share required. |
| USEPA Brownfields (Cooperative Agreements) | To prevent, assess, safely clean up, & sustainably reuse Brownfields. | States, cities, towns, counties, U.S. Territories, & Indian tribes. | Up to \$200,000 granted. | No matching share required. |
| USEPA Superfund Technical Assistance Grants (TAGs) | To obtain technical assistance in interpreting information regarding the site. | Groups affected by an NPL site. All groups must be incorporated as nonprofit organizations. | Up to \$50,000; additional funds may be available. | 20% nonfederal share required; may use in-kind contributions. |
| USEPA Environmental Justice through Pollution Prevention (EJP2) | To use pollution prevention resources for addressing environmental problems in low income, high minority areas. | Any incorporated nonprofit organization, federally recognized Indian tribal government, state, city, county, or local government. | Up to \$100,000 granted. | No matching share required. |
| USEPA Environmental Justice (EJ) | To address environmental justice issues. | Any affected community group, nonprofit organization, university, or tribal government; must be incorporated. | Up to \$20,000 granted. | No matching share required. |
| USEPA Community/University Partnership (CUP) | To efficiently address local environmental justice issues. | Institutions of higher education which have formal partnerships with one or more community group(s). | Up to \$250,000. | 5% nonfederal share required. |

| Grant Program | Purpose | Eligible Applicants | Award Amount | Matching Share |
|---|--|--|---|---|
| USEPA Solid Waste Management Assistance (SWMA) | Demonstration projects of solid waste source reduction, reuse, recycling, and improved landfill technology. | Nonprofit entities, state and local governments. | Limited funds available; typical award less than \$50,000. | No matching share required. |
| USEPA Sustainable Development Challenge (SDC) | To encourage environmentally & economically sustainable business practices. | Local governments, tribes, territories, educational institutions, & incorporated nonprofit organizations. | Up to \$250,000. | 20% nonfederal share required. |
| USEPA Environmental Education (EE) | For projects which design, demonstrate or disseminate environmental education practices, methods, or techniques. | Local, tribal, or state education agencies, colleges & universities, nonprofit organizations, state environmental agencies, & noncommercial educational broadcasting agencies. | Up to \$25,000 granted regionally; \$25,001-\$250,000 nationally. | 25% nonfederal share required. |
| USEPA Wetlands Protection: Development Grants | To support development or enhancement of new and existing state wetlands and their protection, management, or restoration programs. | States, tribes, and local governments. | | Entities must provide a 25% match of the total cost of the project. |
| USDA Conservation Reserve Program | To establish protective covering on cropland and marginal pastureland. | The land must be owned or operated by the applicant for at least 12 months, enrolled in the Water Bank Program (WBP), or contain other environmentally sensitive land. | Annual rental payments for up to 50%, not to exceed \$50,000, of the cost of establishing land cover. | Long-term rental payments and cost-sharing assistance. |
| USDA Watershed Protection & Flood Prevention | For carrying out improvements to protect, develop, and utilize the land and water resources in small watersheds. | State or local agency, county, municipality, or nonprofit entity. | 100% for flood prevention; 50% for nonmunicipal water management construction. | 50% cost share required on some projects. |
| USDA Wetlands Reserve Program | To restore wetlands on private property in exchange for retiring marginal agricultural land. | Landowners must have owned the land for at least 12 months, and it must be restorable and be suitable to provide wildlife benefits. | | Financial incentives and technical assistance. |
| USDA Water and Waste Disposal Systems | For water, sewer, and storm water projects, including the installation, repair, improvement, and expansion of rural water and waste disposal facilities. | Public entities, nonprofit organizations, and federally recognized Indian tribes in rural areas. | | Direct loans, guaranteed loans, and grants. |
| USDA Environmental Quality Incentives Program (NRCS) | To help producers in complying with environmental laws and regulations, including clean water. | Farmers and ranchers who establish conservation practices and systems. | Cost sharing and incentive payments through 5- to 10-year contracts. | Min. 25% for cost share. Max. \$10,000/person and \$50,000 over life of contract. |
| USDA Watershed Surveys & Planning | For the development of coordinated water programs and related land resources in watersheds and river basins. | Federal, state and local agencies. Priority on agricultural nonpoint sources, wetland preservation, and floodplain management. | Planning assistance. | |

| Grant Program | Purpose | Eligible Applicants | Award Amount | Matching Share |
|--|---|---|--|--|
| BUREAU OF INDIAN AFFAIRS Water Resources on Indian Lands | To assist in the management, planning, and development of water and related land resources. | Federally recognized Indian tribes. | | |
| NOAA Coastal Zone Management Awards (CZMA) | For hazard mitigation, providing public access, protecting wildlife and fisheries habitats, and managing land uses that impact water quality. | Coastal states and territories whose CZMA programs have been approved by the Secretary of Commerce. | Allocations are based on a formula including population and shoreline mileage. | State match of 50% required for some programs. |
| DEPT OF COMMERCE Economic Development Administration, Public Works and Development Facilities | To support long-term development and growth in distressed communities. This includes the funding of water and sewer projects primarily serving industry and commerce. | Public, tribal, and nonprofit entities. | | Matching grants. |
| HUD Community Development Block Grants | To develop viable urban communities by providing housing and a suitable living environment, including water, sewer and other facilities. | Entitlement communities must be either a central city in a Metropolitan Statistical Area (MSA), a city with population above 50,000 in the MSA, or an urban county of at least 200,000 people. Funds are also awarded to states for distribution to smaller (nonentitlement) communities. | Formula grants. | |
| FEMA Hazard Mitigation Grant Program | To implement long-term hazard mitigation measures following a major disaster declaration. | States and local governments, certain nonprofits, and Indian tribes. | Up to 75% of total eligible costs. | Match funds or in-kind services required. |

Other federal and state program activities that also may be integrated into local source water protection include:

- Clean Water Action Plan;
- USEPA's Watershed Protection Approach;
- Comprehensive State Ground Water Protection Programs (CSGWPPs);
- Toxic Release Inventory (TRI);
- Transportation Efficiency Act 21 (TEA 21);
- Federal Emergency Management Agency (FEMA); and
- State hazardous materials programs providing financial assistance to clean up sources of surface and ground water contamination.

For more information on these and other funding tools, the following references can be accessed over the Internet.

- **Environmental Finance Program** is a USEPA activity that provides information on over 250 financing tools that local governments and private interests may use to support environmental programs including water protection. For additional information visit the website at <http://www.epa.gov/efinpage>.
- **Catalog of Federal Funding Sources for Watershed Protection** (1997) is another excellent source of information on federal grants and loans that may be used at the local level to fund watershed protection projects. It also contains references to numerous publications and websites that have good information on funding and technical assistance. The Catalog can be accessed at the USEPA's Watershed Academy website, <http://www.epa.gov/OWOW/watershed/wacademy/fund.html>, or requested as publication number EPA841-B-97-008.

Local Funding Tools

Historically, provision of water supply, including funding to secure, treat, and distribute water, has been considered a local responsibility. Some states have provided grant and loan support, but most commonly, it was left to the local government to finance and implement water supply options. This is still true, even though some federal funds are now available. The most common local government funding options include:

Historically, provision of water supply, including funding to secure, treat, and distribute water, has been considered a local responsibility.

- **general tax revenue** that is used to pay for the drinking water system capital costs and operation;
- **rates and surcharges** for drinking water service that adequately reflect the cost and value of drinking water, including source water protection;
- **revenue bonds** typically used for large capital outlays but which can be guaranteed through charges and other revenues;
- **water utility surcharges** that are established primarily for wellhead protection program and other land acquisition; and
- **fee systems** in which communities charge permit fees, plan review fees, or facility inspection fees for regulated entities that pose a potential threat to ground water quality by using or storing hazardous materials.

Summary

Local governments may be most successful in funding source water protection programs if they approach funding options as a menu of opportunities. A combination of federal, state, and local financing mechanisms may provide more funds that go further toward source water protection than does seeking a single funding tool. Finally, existing protection programs that have a goal other than source water protection, but that can be used to meet overlapping objectives, offer an important funding option that should not be overlooked.

PART III

Getting Started on Source Water Protection

Implementing Source Water Protection Programs

Source water protection and management of our water resources are key to the prosperity and wellbeing of our counties.

James D. Campbell, President
Conference of Southern County Associations
(Executive Director,
Virginia Association of Counties)

When designing and implementing a source water protection program, factors that focus resources, measure progress, and provide a check on burdensome activities help tremendously. Source water protection actions should be targeted to geographic areas of priority. Approaches should be selected that can be best applied to specific threat situations. Water monitoring efforts should be included in the protection program to measure progress. In addition, issues of equity in paying for and carrying the burden of protective actions should be considered. These factors can all be considered prior to defining funding needs and pursuing funding options. Local governments can improve their funding requests to maximize their chances of receiving financial support by focusing on actions that target the most significant pollution sources and yield the highest return on investment, in a fair and equitable manner.

Prioritizing Source Water Protection Actions

A variety of factors can be used to prioritize source water protection activities: existing or future threats, degree or location of threat, effectiveness of protection strategy, and funding options. The following discussion will look at prioritizing protection efforts by temporal (existing and future) considerations, geographic (degree and location) factors, and effectiveness (minimization of susceptibility).

Corrective and Preventive Approaches

Source water protection approaches can be grouped into two categories: those actions that correct existing threats to drinking water quality and those actions that prevent future threats from occurring. To ensure that the community water supply remains safe to drink for both current and future residents, it is likely that the local source water protection strategy will need to include both corrective and preventive water protection actions.

Source water protection includes actions that correct existing threats to drinking water quality and that prevent future threats.

Corrective source water protection includes those actions that reduce or eliminate existing threats to the community water system. Remedial measures are generally required to address existing threats to drinking water quality. Local governments will find that more technical and financial assistance is available to address remedial types of protection measures. This consideration may influence prioritization of protection strategies.

Preventive source water protection measures exclude future actions from becoming a threat to drinking water quality or eliminate the possibility of future threats occurring. Although the corrective measures may have funding priority, it is almost always easier and cheaper to prevent source water contamination than it is to clean or remediate the water supply or to find alternate sources of drinking water.

Protection Zones and Areas

Another prioritization strategy is the use of protection zones or areas. Many of the delineation methods used to define the boundary of the source water protection area (see Appendix D) will divide it into priority zones or areas.

High priority zones direct protection in the area closest to the water supply intake. These zones are the most significant to protect from current and potential threats. A **mid-priority zone** is the area next to the high priority zone, moving away from the intake. This zone directs protection actions to reduce contaminants to a specific level or local standard. A **low priority zone**, furthest from the intake, directs protection approaches toward ongoing low-level management actions.⁴⁶

Dividing the source water protection area into **sub-watersheds** or **stream segments**, or establishing **buffers and setbacks** is another way to target protection activities. Efforts can be focused on the segments closest to the drinking water source intake where contaminants represent the highest threat to water quality.

Watershed Protection

Watershed protection measures are among the most effective means for local governments to protect drinking water sources. Unlike health-based, land use, and land management measures that institute a particular type of control, which may address a specific source of pollution, such as wastewater facility requirements, erosion and sedimentation control, or storm water treatment standards, watershed protection seeks to implement a comprehensive protection strategy. At its heart watershed protection requires consideration of water, land, and human activities in an integrated framework. Watershed protection, therefore, involves setting locally meaningful standards and establishing local protection approaches that integrate the water, land, and

Watershed protection measures are among the most effective means for local governments to protect drinking water sources.

human elements. Over the long run, watershed protection may be the most effective and the most cost-effective strategy for source water protection.

Recognizing Specific Threats

The location of potential contamination sources will be identified during the source water assessment process. However, determining how and when to use the various protection tools can be confusing. If a community faces threats to its drinking water supply from a specific type of activity, Table 3 may help identify which of the tools in the source water protection toolbox will be the best control option. All of the tools have been discussed in Part II The Source Water Protection Toolbox section of this document.

Table 3. Local Tools for Specific Threats

| Activity | Source | Local Tools |
|------------------------------|--|--|
| Agriculture | | |
| Animal feedlots | Waste lagoons; Land application of waste; Loafing areas; Pastures | \$ Health regulations: Discharge requirements \$ Zoning: Siting, overlay districts, critical area zone, floodplains \$ Buffer & setback zones \$ BMPs: Nutrient loading standards \$ Restoration: Re-siting \$ Pollution prevention: Source management & disposal, education |
| Fertilizer | Land application | \$ Zoning codes: Critical area zoning \$ Buffer & setback zones \$ BMPs: Nutrient loading standards \$ Pollution prevention: Source management, education |
| Pesticides Herbicides | Land application | \$ Health regulations: Contaminant bans & use controls \$ Zoning codes: Critical area zoning \$ Buffer & setback zones \$ Pollution prevention: Source reduction & management, education |
| Shallow well injection | Agricultural drainage wells | \$ Health regulations: Well closures \$ Zoning codes: Critical area zoning \$ Pollution prevention: Source reduction, management & disposal, education \$ Emergency response planning |
| Irrigation | Return flows Chemigation | \$ BMPs: Agricultural management, flushing & dilution \$ Pollution prevention: Source management, education |
| Construction | | |
| Residential Commercial | Runoff from disturbed land; Runoff from impervious surfaces | \$ Zoning codes: Critical area zoning, floodplain management \$ Impact fees \$ Buffers & setbacks \$ Development agreements \$ Subdivision regulations: Site design, sediment & erosion control \$ Building codes: Porous pavement, impervious surfaces limits, excavation, grading & seeding, phased development \$ BMPs: Grass swales, infiltration basins, runoff ponds \$ Pollution Prevention: Source reduction & management, education |
| Industrial Transportation | Runoff from disturbed land; Runoff from impervious surfaces | \$ Zoning codes: Critical area zoning, floodplain management \$ Impact fees \$ Buffers & setbacks \$ Development agreements \$ Building codes: Porous pavement, impervious surfaces limits, excavation, grading & seeding, phased development |

| Activity | Source | Local Tools |
|--------------------------------------|---|--|
| | | \$ BMPs: Grass swales, infiltration basins, runoff ponds \$ Pollution Prevention: Source reduction & management, education |
| Forestry | | |
| Harvesting operations | Road construction and maintenance; Runoff from disturbed sites | \$ Buffers & setbacks \$ BMPs: Grass swales, infiltration basins, runoff ponds \$ Pollution Prevention: Source reduction & management, education |
| Fertilizer | Land application | \$ Zoning codes: Critical area zoning, floodplain management \$ Buffers & setbacks \$ BMPs: Grass swales, infiltration basins, nutrient loading standards \$ Pollution Prevention: Source reduction & management, education |
| Pesticides/herbicides | Land application | \$ Health regulations: Contaminant bans & use controls \$ Zoning codes: Critical area zoning \$ Buffer & setback zones \$ Pollution prevention: Source reduction & management, education |
| Fire management | Ash and sediment runoff | \$ Buffers & setbacks \$ BMPs: Grass swales, infiltration basins, runoff ponds \$ Pollution Prevention: Source reduction & management, education |
| Industry | | |
| Storage tanks (above & under ground) | Hazardous & nonhazardous materials & waste | \$ Health regulations: Contaminant bans & use controls, underground tank requirements \$ Zoning codes: Critical area zoning, floodplain management \$ Buffer & setback zones \$ Restoration: Re-siting & remediation \$ Pollution prevention: Source reduction, management & disposal, education \$ Emergency response planning |
| Injection wells | Hazardous & nonhazardous waste; Industrial process water disposal | \$ Health regulations: Contaminant bans & use controls, well requirements, well closures \$ Zoning codes: Critical area zoning, floodplain management \$ Buffer & setback zones \$ Restoration: Remediation \$ Pollution prevention: Source reduction, management & disposal, education \$ Emergency response planning |
| Land application | Industrial waste; Industrial sludge; Petroleum refining waste | \$ Health regulations: Contaminant bans & use controls \$ Zoning codes: Critical area zoning, floodplain management \$ Buffer & setback zones \$ BMPs: Runoff ponds, constructed wetlands \$ Pollution prevention: Source reduction & disposal, education |
| Landfills | Industrial hazardous & nonhazardous waste | \$ Zoning codes: Siting, critical area zoning, floodplain management \$ Buffer & setback zones \$ BMPs: Runoff ponds \$ Pollution prevention: Source management & disposal, education |
| Material transfer operations | Hazardous & nonhazardous material & waste | \$ Zoning codes: Siting critical area zoning, floodplain management \$ Buffer & setback zones \$ BMPs: Runoff ponds \$ Pollution prevention: Source management & disposal, education \$ Emergency response planning |
| Pipelines | Hazardous & nonhazardous material & waste | \$ Utility requirements \$ Buffer & setback zones \$ Pollution Prevention: Source reduction & management, education \$ Emergency response planning |
| Surface impoundment | Waste lagoons & storage ponds | \$ Health regulations: contaminant bans & use controls \$ Zoning codes: Siting, overlay districts, critical area zoning, floodplain management \$ Buffer & setback zones \$ Restoration: Re-siting \$ Pollution Prevention: Source reduction, management & disposal, education \$ Emergency response planning |

| Activity | Source | Local Tools |
|--|---|--|
| Superfund sites | Hazardous waste; petroleum releases | \$ Buffer & setback zones \$ Restoration: Remediation \$ Pollution Prevention: Source reduction & management |
| Radioactive storage & disposal | Hazardous wastes from hospitals and laboratories; transportation spills | \$ Buffer & setback zones \$ Restoration: Remediation \$ Pollution Prevention: Source reduction & management \$ Emergency response planning |
| Permitted discharges | Toxic releases; Air emissions; Water discharges; Hazardous waste disposal | \$ Pollution Prevention: Source reduction, management, disposal & education \$ Emergency response planning |
| Permitted facilities | Solid waste disposal | \$ Zoning codes: Siting \$ Solid waste ordinance \$ Buffer & setback zones \$ BMPs: Grass swales, runoff ponds & wetlands \$ Pollution Prevention: Source reduction, management & education |
| Mining | | |
| Injection wells | Oil & gas activity disposal; Mineral extraction disposal | \$ Pollution prevention: Source reduction, management & education \$ Restoration: Re-siting & remediation \$ Emergency response planning |
| | Hydrocarbon releases | \$ Health regulations: Well closures \$ Restoration: Re-siting & remediation \$ Pollution prevention: Source reduction, management, disposal & education \$ Emergency response planning |
| Pipelines | Hydrocarbon releases | \$ Pollution prevention: Source management & education \$ Emergency response planning |
| Stockpiles/waste piles | Mining & mine drainage; Quarrying; Mineral extraction; Tailing piles | \$ Buffer & setback zones \$ BMPs: Runoff ponds & wetlands \$ Pollution Prevention: Source reduction, management, disposal & education \$ Restoration: Re-siting & remediation |
| Urban (commercial & residential) | | |
| Storage tanks (above & under ground) | Hazardous Nonhazardous materials & waste | \$ Health regulations: Contaminant bans & use controls, underground tank requirements \$ Zoning codes: Siting, critical area zoning, floodplain management \$ Buffer & setback zones \$ Restoration: Re-siting & remediation \$ Pollution prevention: Source reduction, management & disposal, education \$ Emergency response planning |
| Stockpiles/waste piles | De-icing salts storage | \$ Buffer & setback zones \$ Pollution Prevention: Source reduction, management & education \$ Restoration: Re-siting & remediation |
| Cemeteries & graveyards | Chemical & pathogenic contamination | \$ Zoning codes: Siting \$ Buffer & setback zones \$ Restoration: Re-siting & remediation |
| Ground water Surface water cross connection | Unused wells; Abandoned wells; Broken sewer & storm water drains | \$ Health regulations: Well closures, sewage discharge & management \$ Storm water management: Intergovernmental coordination & consistency, storm water infiltration facilities \$ Restoration: Remediation |
| Land application | Fertilizer; Pesticides & herbicides; Wastewater | \$ Health regulations: Discharge requirements, sewage discharge & management \$ Zoning codes: Siting, overlay districts, critical area zoning, floodplain management \$ Buffer & setback zones \$ BMPs: Nutrient loading standards, fertilizer limits |

| Activity | Source | Local Tools |
|--------------------------|---|--|
| | | \$ Pollution prevention: Source management & disposal, education |
| Landfills | Municipal Landfills; Open dumps; Scrap tire piles | \$ Zoning codes: Siting \$ Solid waste ordinance \$ Buffer & setback zones \$ BMPs: Grass swales, runoff ponds & wetlands \$ Pollution Prevention: Source reduction, management & education \$ Restoration: Re-siting & remediation |
| Impervious Surfaces | Runoff from streets, roads & parking lots | \$ Subdivision requirements: Site design \$ Building codes: Impervious surface limits, porous pavement \$ BMPs: Grass swales, infiltration basins, \$ Storm water management: Intergovernmental coordination, storm water infiltration facilities |
| Permitted discharges | Air emissions; Water discharges; Solid & hazardous waste disposal | \$ Pollution prevention: Source reduction, management & education |
| Septic tanks | Individual houses; Multi-family units; Small businesses | \$ Health regulations: Design standards, on-site sewage management controls \$ Zoning codes: Siting, overlay districts, floodplain management, critical area zoning \$ Building limitations \$ Subdivision regulations: Site design, on-site wastewater controls \$ Restoration: remediation |
| Disposal wells | Storm water drainage; Automobile service station disposal | \$ Health regulations: Design standards, on-site sewage management controls \$ Zoning codes: Siting, overlay districts, floodplain management, critical area zoning \$ Storm water management: Intergovernmental coordination, infiltration facilities \$ Pollution prevention: Source reduction, management & education \$ Emergency response planning |
| Surface impoundment | Cesspools; Waste lagoons | \$ Health regulations: On-site sewage management controls \$ Zoning codes: Siting, overlay districts, floodplain management, critical area zoning \$ Subdivision regulations: Site design, on-site wastewater controls \$ Pollution prevention: Source reduction, management & education \$ Emergency response planning |
| Other | | |
| Saltwater intrusion | Saltwater | \$ Conservation & reuse \$ Awareness & education |
| Transportation corridors | Runoff from disturbed sites & impervious surfaces; Herbicide application; Hazardous & Nonhazardous materials & waste spills | \$ Health regulations: Contaminant bans & use \$ Zoning: Siting of highway & road location, critical area zoning, overlay districts, floodplain management \$ Buffers & setbacks \$ Subdivision regulations: Site design, sediment & erosion control \$ BMPs: Grass swales, excavation, grading & seeding, runoff ponds \$ Storm water management: Intergovernmental coordination & agreements, infiltration facilities \$ Emergency response planning |

Water Quality Monitoring

It is difficult to determine the effectiveness of local source water protection efforts unless a record of the quality of the water is kept. Tracking the effectiveness of protection efforts lets a community know if they are making improvements to their drinking water quality and allows the source water protection plan to adapt to new information and

It is difficult to determine the effectiveness of local source water protection efforts ...

changing conditions. Water monitoring provides the information on which to adapt the plan to emphasize management efforts that offer the most protection for the least investment of resources. Therefore, in addition to the water monitoring that is required by the state related to the drinking water withdrawal permit, local governments could benefit from a broader effort that is targeted toward locally adopted water quality criteria or concerns.

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Water quality monitoring is an area where community-based volunteer efforts have been successful. Programs like adopt-a-stream or adopt-a-lake often train volunteers and provide them with monitoring equipment. In addition, stakeholders such as retired seniors and youth groups can support protection of local lakes, rivers, and ground water sources by gathering water quality monitoring samples.

Equity in Responsibility and Expense

Protecting drinking water supplies can be a difficult effort when legal and fiscal responsibilities cross jurisdictional lines and/or when significant portions of the source water protection area consists of privately owned land. Local government can play a key role in achieving regional cooperation for a comprehensive approach to multi-jurisdictional water resource management. In addition, local government will be key in accomplishing source water protection measures on private land. Because issues of responsibility and equity (who pays and who benefits) may hinder protection activities, the American Water Works Association has developed the following guidelines to help resolve these concerns.

- Sources of pollution bear the responsibility for problem remediation; the polluter pays.
- Open and active communication, flexibility, and participation in the source water protection process by involved parties can overcome actual and perceived inequities.
- Federal, state, and local resources can be applied to help address the equity issue.
- Consideration should be given to the value that source water protection programs can provide to a community through environmental benefits, such as wildlife habitat and open space, as well as improved water quality and quantity.
- Some funds should be available for appropriate compensation for lost or diminished use of property because of source water protection restrictions on private property.⁴⁷

Summary

Issues of equity should be explored when approaching funding considerations. A fair and open process that balances who pays for and who benefits from source water protection actions is likely to place local governments in a better position to receive financial support and to implement their programs. In addition, source water protection actions should be prioritized according to an acceptable strategy so that time, resources, and funding can be targeted to effectively minimize the contamination threat.

Conclusions

Water issues are a developing priority for local governments. Education and public input are key to local decision-making.

George W. “Bubba” Bird, III, Chairman
Candler County, Georgia

A reliable supply of safe drinking water is essential for communities to survive and prosper. In fact, from a public health, environmental quality, economic development, public finance, and quality of life perspective, there are few things more important for local government officials to ensure for their residents.

Historically, local governments have provided water supplies for public purposes. Securing, treating, and distributing water have been local responsibilities, if the local government chose to undertake them. Financing these services was also left to the local government. This is still true today, but there is greater federal and state involvement in the drinking water arena.

Since the passage of the Safe Drinking Water Act in 1974, the focus of federal and state efforts relating to drinking water quality has been primarily on requiring that drinking water be treated to meet certain standards. With enactment of the 1996 amendments to the Act, greater emphasis was placed on protecting the sources of drinking water from water quality contamination. The thrust of the amendments is to require source water assessments to be conducted with the intent that, once the assessments are completed, source water protection measures will be voluntarily instituted. The USEPA has established a national goal that by the year 2005, 60 percent of the population that is served by community water systems will receive drinking water from systems with established source water protection programs.

The first step in protecting water sources is for source water assessments to be conducted. The 1996 amendments to the Safe Drinking Water Act require states that have primary enforcement responsibility (primacy) for the Safe Drinking Water Act to develop and submit a source water assessment plan for approval by the USEPA. Within two years of plan approval (with a possible 18-month extension), states are required to have completed assessments of all community water systems that include:

- delineation of the source water protection area,
- inventories of certain contamination sources, and
- determinations of susceptibility of the drinking water source to contamination.

Responsibility for the source water assessment will vary by state. Consequently, local government officials should contact their state agency with drinking water responsibility to determine how the assessments will be done in their area. Whether the assessment is to be done by the state or by the local government, the local government should be involved in the process. Drinking water utilities and local governments must remember that assessments are intended to be the basis on which to institute source water protection measures.

The source water assessments provide specific information on threats to local water supplies and the degree of risk associated with those threats. Consequently, in developing source water protection programs, higher priority can be assigned to those threats that pose the greatest risk to the water system.

Once the source water assessments are completed, the next step in protecting water sources is to develop a source water protection plan. The plan must consider the threats to the water sources and identify alternatives for addressing them. Options available to local officials to protect water sources include:

- **land use tools** (i.e., zoning, subdivision regulations, building codes, land management actions, storm water management actions, remediation and restoration); and
- **wet weather runoff control and restoration tools** (i.e., storm water management, erosion and sedimentation control, restoring contaminated sites);
- **public health tools** (i.e., contaminant specific health measures, source specific health measures); and
- **nonregulatory tools** (i.e., pollution prevention, land acquisition, water conservation and reuse, public education and awareness, emergency response planning).

Each local source water protection plan will be unique based on the hydrogeologic characteristics of the drinking water source, the presence and type of threats in the vicinity of the water supply, and the measures adopted by the local government to address those threats. To ensure that the community water supply remains safe, it is likely that the source water protection plan will include both corrective and preventive water protection measures.

Clean, safe drinking water sources are essential for community well-being. Consequently, it is important for local government officials to be involved in the source water assessment program and to move aggressively toward protecting water supplies once the assessments are completed. Source water protection programs should involve a partnership of federal, state, and local governments, stakeholders, and the general public that focuses efforts on protecting sources of drinking water. An open, cooperative effort can identify and minimize threats to drinking water quality, safeguard current and future citizens from water-borne maladies, protect environmental quality, and support the economic viability of the community.

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